DEPARTMENT OF RAILWAYS AND CANALS

REPORT

OF THE

HUDSON'S BAY RAILWAY SURVEYS

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
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1909

[No. 20*d*—1910]

REPORT

ON THE

HUDSON BAY RAILWAY PROJECT

October 30, 1909.

Hon. GEORGE P. GRAHAM,
Minister of Railways and Canals,
Ottawa, Ont.

SIR,—I have the honour to report upon the Hudson Bay Railway project, as follows:—

Mr. John Armstrong, B.A., B.A.Sc., M. Can. Soc. C.E., was appointed Chief Engineer in the fall of 1908. He promptly organized four parties and carried on his work in a most satisfactory manner, and to him and his assistants credit is due for an efficient piece of work. Lines were run to Fort Churchill and Port Nelson from the Pas Mission, and contours were taken closely enough to enable a projected location to be made that reasonably assures accurate quantities; and detailed surveys were made of the harbour at Port Churchill and Port Nelson—and at important river crossings.

The basis of Mr. Armstrong's estimate is given in full detail. He has estimated for 60 pound rails; I have increased his estimate to provide for 80 pound rails and fastenings; and as he has not estimated for round houses, shops, buildings, elevators and yard facilities at terminals, or harbour works, I have accordingly estimated for these items.

I find considerable difficulty in deciding upon what basis to provide accommodation for a railway that, in the nature of things, cannot be operated to its capacity for more than two months in the year—to a lessened extent for a possible three months, and for the remainder of the year still less. I have, however, provided facilities on a scale that will admit of the maximum capacity for a single track: passing tracks and telegraph stations every five miles; water stations every fifteen miles, and round house and shop accommodation sufficient to care for thirty-two (32) freight trains and one (1) express train per day of twenty-four (24) hours.

Mr. Armstrong has discussed the merits of the harbours at Churchill and Nelson: and as he has furnished plans with soundings, I have plotted the piers and terminals required.

From the information, there is no room for doubt that Nelson is much the better harbour. The line is also shorter by 67 miles, the country through which it runs is better, and the possibility of local business altogether with the Nelson route. There is also a probability that a fair proportion of the route is available for settlement; whereas on the Churchill route, there is no such probability beyond Split lake, where the lines separate.

It is of the utmost importance that a hydrographic survey should be made of the Hudson strait and bay, so that the position and cost of the necessary lighthouses may be ascertained. This work properly belongs to the Marine Department, and is important enough to demand the personal attention of its most capable officer; and while in progress, complete observations should be taken by reliable men stationed at Cape Chidley and Resolution island, at the mouth of Hudson strait, at Salisbury island near the junction of the Fox channel, and at Mansfield island, as well as at the mouth of the Nelson itself. The course from Mansfield island to Nelson requires to be accurately chartered, and the exact positions of the lighthouses necessary at the mouth of the channel should be fixed. It would be well to also secure information as to the harbours on the Labrador coast, and the special feature of Davis strait. A good sea-going boat is required at Nelson for a year or two, to study the bay itself, its tides, currents, &c. Particular study should be made of the mouth of Ungava bay; and also, as to all harbours of refuge along the route and the best way to approach them, where safe anchorage may be had, &c. A lighthouse will be required at the most southerly end of Greenland.

The route will pass to the north of Ireland, and the distance from Liverpool to Port Nelson, as measured on a mercator projection map, is 3,200 miles—against 3,007 from Montreal to Liverpool.

The crux of the matter is—what business can be handled by such a railway, and of what value it is likely to be to the country tributary to it? The general map of the Northwest, which accompanies the report, shows, by concentric circles, the areas tributary to Pas Mission (the starting point of our line) and Winnipeg. For all practical purposes the city of Winnipeg is as close to Fort William as the Pas is to Hudson bay at Port Nelson, hence they may be compared as radiating points.

A line drawn from Dauphin, Man., in a southwesterly direction passing through Weyburn, Sas., separates the tributary territory. Practically the whole of the province of Manitoba, and about 11,000 square miles of the southeasterly corner of Saskatchewan, is tributary to Winnipeg; the whole of the remaining area of Saskatchewan and Alberta belonging to the Pas. This immense district is equal in area to the states of North and South Dakota, Minnesota, Wisconsin, Nebraska and Iowa, where there is a population of about 10,000,000, and a railway mileage of about 50,000. I think that, square mile to square mile, the fertility of the northwest is at least equal to the states named.

Assuming that the line is to be worked for all that is possible to be done. The grades are 0·4 or 21 feet to the mile. All trains are fully loaded and composed of 40 ton pay load cars; and locomotives of the Mallet articulated compound type are to be used with a hauling power of at least 4,000 tons of pay load. Thirty-two (32) trains

per day is about the capacity of a single track—better than this has been done, but it is enough.

Sixteen (16) trains loaded=64,000 tons per day—making allowance for accidents and delays—say for 30 working days we get 1,930,000 tons, or 64,000,000 bushels of wheat.

I assume that ships can be secured wherever there is sufficient business offered. It is apparent that at least nine per day would need to be loaded, or say 135 to 140, to do the business—allowing 2 trips to each ship. Any additional business taken to the bay would have to be stored until the following August—nine months.

Other sources of traffic possible to the line are: the exportation of cattle; the usual package freight to and from Europe; and the possibility of developing a reasonably large import coal trade. I believe it is practicable to lay down coal at Port Nelson from Nova Scotia at a cost not exceeding $3.75 per ton. The rail haul say to Saskatoon—as an average point of distribution—need not exceed $4 per ton, making the cost of the coal $7.75. At present, I believe, it costs quite $9 in the same territory.

Equipment for thirty-two (32) trains per day of the character outlined will cost about $9,000,000; and means the providing of 108 train crews, 150 telegraph operators, 54 gangs of section men, shopmen, round house men, superintendents, train and yard masters—the greater number of whom are not likely to be required once the rush of the season is over. It appears, therefore, to be a difficult proposition for independent operation, and would seem to require to be worked by one of the large corporations, so that the men and rolling stock could be utilized the whole year. There is in Canada only one locomotive of the type described, and by using the largest freight engines now operated on western roads the train load would be reduced one-half—and the capacity of the road in like measure.

It is apparent, however, that under any circumstances grain may be placed at the Hudson bay on board ship as cheaply as at Fort William, hence the saving possible is 5 cents per bushel, assuming that insurance and freight rates are equal at Montreal and Port Nelson. Captain Bernier is of the opinion that it is unsafe to be caught in the vicinity of the Fox channel with a steamship of ordinary construction, any later than October 15th.

Mr. Armstrong's report will be found attached hereto.

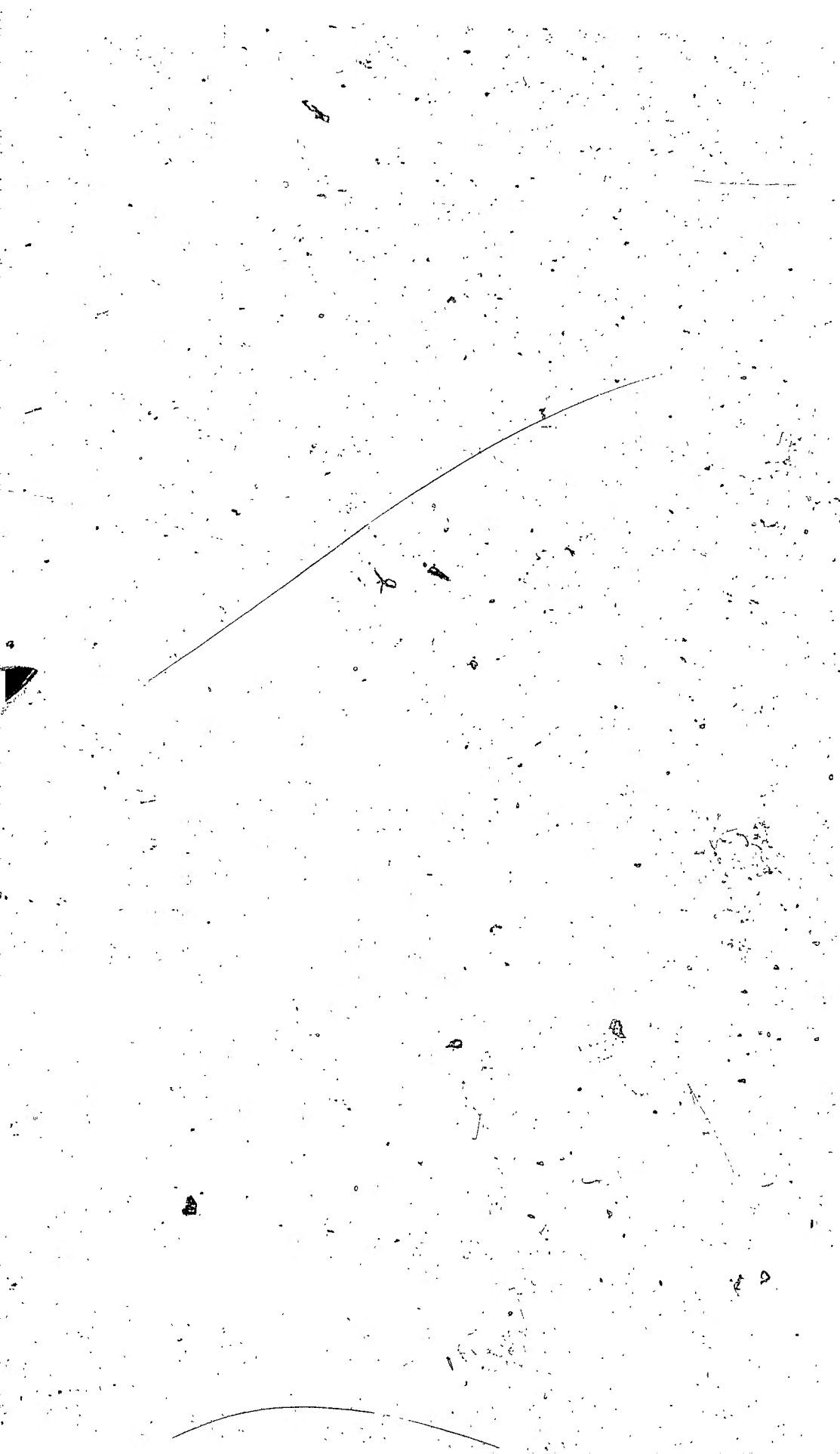
I have the honour to be, Sir,

Yours faithfully,

M. J. BUTLER,

Deputy Minister and Chief Engineer.

October 21, 1909.



Mr. M. J. BUTLER,
Deputy Minister and Chief Engineer,
Department of Railways and Canals,
Ottawa.

DEAR SIR,—I herewith beg to submit a general report on the results of the preliminary surveys in connection with the proposed railway to Hudson bay, and undertaken in accordance with your letter of instructions dated July 10, 1908.

ORGANIZATION.

Four parties were organized and started to work at various points between The Pas and Port Churchill, dividing the territory to be covered into sections of approximately 120 miles each. Another small party, No. 5, was organized for the purpose of exploratory work whereby much general information was obtained, and the running of much unnecessary lines by the regular parties avoided.

During the progress of the work more information about the Nelson river was obtained, and seemed to justify an examination of that route, as well as the route to Churchill. On the completion of their exploratory work Party No. 5, was re-organized and allotted to this work, and to a preliminary survey of the harbour at the mouth of the Nelson river. In order that no hitch might occur in the transportation and supply arrangements, Mr. E. H. Drury was established at Split lake as divisional engineer, supervising the work of parties 3, 4 and 5.

Parties 1 and 2 were despatched from Winnipeg on August 30, to the Pas, going by rail to Prince Albert and thence by Hudson Bay Company's steamers down the Saskatchewan river to their destination. Party No. 1 commenced work on September 14, about 40 miles north of The Pas. Party No. 2, owing to the long and difficult route adopted, did not arrive on their work until November 7, the last of the five parties to commence work. Since then we have discovered a much easier and quicker route to the work, and could do the same work now in less than half the time and for half the expense.

Parties 3, 4 and 5 left Winnipeg on September 19, going by way of Lake Winnipeg and the Nelson river to their destination. Party No. 5 commenced work on October 5, No. 3 on October 24, and No. 4 on October 29.

Parties 1 and 2 completed their work and were disbanded on March 11 and 24, respectively. Party No. 3 and the Split Lake Division office was disbanded on April 6.

Parties No. 4 and 5 completed their work on the railway lines about April 1, and were thereafter engaged on the harbour surveys, No. 5 completing their work and disbanding on July 6, and No. 4 on August 13.

The health of the parties throughout the work was uniformly good; not a single serious accident or case of sickness being recorded on all the work.

COST.

The total cost of the work, including all returns to date of September 30, with outstanding accounts yet to be settled, totals $130,716.09. A few of the outstanding

accounts are in process of adjustment, but the final result will not differ materially from this total.

Since commencing location, supplies and equipment to the extent of $5,952.34 have been taken over for location work, leaving $124,763.75 to charge against preliminary work, and distributed as follows. Survey of railway routes $101,123.75. Surveys of harbours $23,640. This cost is largely due to the extra expense of transportation through such a country, a considerable portion being due to the fact that the work on the Nelson route was not taken up until well on in February, thus obliging us to pay winter rates for the transport of provisions along this route. The experience of the Canadian Northern and Grand Trunk Pacific seems to indicate that it usually costs from $300 to $500 per mile to secure a final location in such country as this. During the progress of our work much information has been gained relative to transportation routes, which will enable us to greatly reduce the cost of supplies in future, and although the preliminary work has seemed costly I do not expect that the cost of the final location will be greater than that usually obtained in such countries.

During the time when all parties were at work there was an average of about 110 on the pay-rolls.

METHODS USED.

The surveys were made in the usual way with transit level and chain. Contour topography was taken over the greater portion of the line, as well as all lakes, swamps and other points of interest in the vicinity of the line. In order to illustrate more fully the class of information obtained by the engineers in the field a plan and profile of a representative portion of the line are being forwarded to you. This will probably show more clearly than any description could do, the character of the information upon which the estimate of the cost of construction has been based. This plan is exactly as turned in by the engineer in the field.

In making up the estimate different methods of dealing with stream crossings were frequently adopted, this plan only being intended to illustrate the information obtained.

NATURAL RESOURCES.

The timber along the proposed route to Churchill has been described in the preliminary report of February 15, 1909. The work on the Nelson route since then has, however, developed the probability that the timber which may be available by the opening of that route is of much greater value than usually supposed. The whole country is full of lakes and streams, and different parties passing through by different routes have found most of the lakes and streams bordered by areas of timber of commercial value. These areas vary in size from a few acres to some as large as forty or fifty square miles, and in the aggregate totaling several thousand square miles. We have no means of making an approximate estimate of the quantities, as large areas though tributary to the railway route lie far to one side or other of any probable location of the line, and consequently were not visited by the engineers. However, the information obtained is of such a nature as to warrant the recommendation that a thorough examination be made of the timber resources of this territory by competent timber cruisers.

AGRICULTURAL LANDS AND MINERALS.

No further information can be added to that already given in the report of February 15. It will be remembered that the greater portion of this work was completed during the winter months when the ground was frozen and covered with snow, rendering it impossible to obtain much information on these subjects.

It may be remarked here, however, that although these lands may require more or less improvement in the way of clearing and drainage, the fact that they are situated within a few hours' run of an ocean port may give to these lands a value not hitherto thought of, and may cause a more rapid settlement than expected. At the inland Hudson bay posts all kinds of grain and vegetables have been grown successfully for years. A study of the records of the Meteorological Office indicates that the climate is quite as favourable for farming operations as that of Prince Albert. Our own records extending only from November to March simply corroborate the general impression that it is very cold during the winter months, but furnish no information as to the conditions during the summer, or growing season.

Our definite knowledge of minerals is limited to limestone and marble. The limestone occurs in the southern portion of the line a short distance from The Pas, in unlimited quantities favourable for quarrying, and will probably prove the future source of supply for the greater part of the province of Saskatchewan and Manitoba.

Marble of a very high grade occurs on Marble island in Hudson bay, and is also found of a fair quality at Port Churchill.

Iron ores, gold, silver, galena, mica and other minerals have been discovered by the Geological Survey at various localities on the bay, all of which are fully described in the reports of that department.

Various specimens of the precious metals have been shown to our engineers, but their origin was preserved in so much mystery that they could not be treated as evidence of the existence of the metal in that territory and might have been used with equal effect to demonstrate the richness of a deposit in Colorado or Johannesburg.

FISH.

All the evidence obtainable points to the existence of various varieties of fish of good quality in Hudson bay in large quantities. This should be of great value to the west, as fresh fish can be laid down in twenty-four hours at all the main centres in Manitoba and Saskatchewan. This will largely be an express traffic, and according to recent investigations of the Railway Commission this seems to be a remunerative business, and should prove a source of great profit to the Hudson Bay Railway.

STREAMS AND WATERWAYS.

The principal waterways of the country traversed by the surveys were described in the report of February 15. Since then a general map has been prepared showing, in addition to the streams described, the extension of these waterways throughout the west, together with the railway system as it exists at present. The map shows the principal waterways which are susceptable of development for purposes of navigation, and shows the extent to which they may become feeders of the Hudson Bay Railway. These waterways have all been recently navigated by vessels of considerable size. During the summer of 1908 the steamer *Alberta* made the trip from Edmonton to Winnipeg where she is now engaged in the excursion business. During the past summer a good sized steamer made a return trip on the South Saskatchewan between Medicine Hat and Saskatoon, and in the month of June a number of business men from Grand Forks, North Dakota, made a successful excursion trip from Grand Forks to Winnipeg and return via the Red river.

An approximate estimate of the discharge of the Nelson river gave results as follows:—No. 1, 156,869 cu. ft. per second; No. 2, 149,693 cu. ft per second.

In the first measurement the velocity was obtained by means of floats, and in the second by means of a current meter borrowed from the Department of Public Works.

Below this, several large streams enter, and many small ones, so that the discharge at Port Nelson is probably not far from 200,000 cu. ft. per second. The discharge of the Churchill river has been roughly estimated as 40,000 cu. ft. per second at low water.

On the general map is also shown a proposed extension of the railway line southerly to connect with the existing railways.

One projection is shown along the Carrot river from The Pas to Saskatoon. At Saskatoon connection is made with lines leading to most of the principal centres of trade in the provinces of Saskatchewan and Alberta.

This line will also open up a very fertile country along the Carrot river and give an outlet for valuable timber areas along the northern slope of the Pasquia Hills. This line will be through open prairie country and a first-class road can be built for $20,000 per mile.

Another suggested extension is from the southern terminus of the Canadian Northern Railway's Pas branch to Yorkton, giving communication with Regina and other centres in eastern Saskatchewan and western Manitoba. This line will also be prairie work and should not exceed $20,000 per mile for a good road.

THE CHURCHILL ROUTE.

The first section of approximately 120 miles is through a comparatively level or smooth country, affording easy grades and cheap construction. The territory is underlaid with limestone in horizontal or flat beds, rarely rising above the general level to any extent, and when it does so it is in such a way as to be easily avoided by the railway line. Owing to this condition the rock cutting on this section will be practically nil.

The balance of the grading on this section will largely be in clay loam material, probably 70 per cent, the remainder being of sand, gravel and swamp or muskeg. It may be remarked here that what is called muskeg in this country is not a true muskeg, but would be more properly defined as swamp. Good bottom is usually obtained at a depth of three or four feet, and very seldom exceeds 7 or 8 feet.

The stream crossings will be light, with the exception of the Saskatchewan river crossing. Frog river, the connection between Moose lake and Cormorant lake, is a navigable stream for small boats, and as we cross it very low down it will probably be necessary to provide a swing span of some kind. As a fifty or sixty foot opening will do, the sum required will not be large.

Since taking up the location work it has been found possible to practically eliminate the hump shown at mile 25 on the condensed profile, and with good prospects of materially improving the hump at mile 55.

The second section of 120 miles is through granite country, and although the same general characteristics are preserved the granite ridges are more abrupt, and will force us to take some rock cuttings, although fortunately most of them will be small. All the streams and lakes throughout these two sections possess more or less valuable timber of which the accompanying photograph is an illustration.

From the 240th mile to the 360th mile we have the roughest country encountered, and considerable exploratory and extra preliminary work has failed to find any better route than that adopted. In this territory is included the rise between the basin of the Nelson river and that of the Churchill. The actual height of the summit between the two rivers is not very great, but both approaching and leaving this summit a heavily rolling or undulating country is encountered, and requires the development of a considerable length of line, and the introduction of much curvature to secure the grades adopted, at a reasonable cost. On the Nelson river side of this ridge a considerable amount of heavy work will be necessary, but on the Churchill slope although the yardage to be moved will be heavy it is not anticipated that much rock will be encountered.

The fourth section, extending from the 36th mile to Port Churchill will require the moving of only a light yardage, but the northern 70 miles being over the tundra, or barren lands, may prove to be a more expensive piece of work than the profile would indicate. Mr. W. J. Clifford made a trip through this section in the month of June for the purpose of examining it after the snow had disappeared. He does not anticipate any serious difficulty or danger in constructing this section, the chief drawback being from the fact that although the material is such as would usually be classified as common excavation, so much frost will be encountered that probably a considerably greater price will have to be paid for its handling than for common excavation.

The timber over sections 3 and 4 is not of very much value. A few ties and some timber for temporary work may be obtained but only in small quantities.

The bridging on the whole will average light, the only two bridges of great importance being the Saskatchewan crossing and the Deer river crossing about mile 350.

As intimated in the notes on the estimates, a considerable number of small pile structures have been designed for the purpose of furnishing ample waterway until a sufficient observation of the stream will better enable us to specify a suitable permanent structure.

The curvature as estimated from the projected location averages 9° 55′ per mile.

The grades adopted, viz.: ·4 northbound and ·6 southbound, have been obtained without great effort and although some development was required on section 3, the ease with which they were obtained on the remaining sections seems to justify their use all through for the sake of uniform grades on all engine divisions.

THE NELSON ROUTE.

The route selected towards Port Nelson follows the Churchill route for some 150 miles or thereabouts, the description of which has been given. Unlike the Churchill route, the Nelson route does not resolve itself into natural divisions each presenting different characteristics peculiar to itself, but throughout maintains a generally uniform appearance so that the description given for the first division of the Churchill route may be applied in a general way to the whole of the Nelson route. It is not expected that the rock work will amount to very much, the major portion of the grading being in clay loam with smaller percentages of sand, gravel and swamp. The tundra is not encountered on this route, the whole line being through timber not appreciably different from that described on the first 200 miles of the Churchill route. It may be mentioned here that sand and gravel has been found sufficiently often to justify our belief that ballast may be had without unduly long hauls, except on the northern 70 or 80 miles of the Churchill route. It may be found there, but as yet we have not noted it. The curvature has been estimated to average about 5° 30′ per mile over this route.

A grade of ·4 both ways may be had on this route.

The adoption of ·6 against southbound traffic would not help alignment nor save grading.

There are three important bridges on the Nelson route, viz.: the Saskatchewan, the crossing of the Nelson at Manitou rapids, and the second or lower crossing of the Nelson. The Manitou crossing of the Nelson is a particularly favourable crossing, the river here being confined in one channel of less than 350 feet in width, the banks being of merely perpendicular granite rock and so situated as to make it possible to choose almost any desired elevation between fifty and one hundred feet above the water. Water here is of course very deep, and has a current of from six to eight miles per hour, making it necessary to cross with either a single span or an arch. The lower crossing will be much longer, probably 3,000 feet, from grade to grade, with a waterway of 1,500 feet with the grade line approximately 80 feet above the water. The balance of the bridging will be light, trestles being sufficient in all cases with the exception of Frog river.

HARBOUR WORK.

The plans and reports of the terminal work having already been sent you, it will only be necessary to treat briefly of the object with which this work was undertaken.

It has been endeavoured to treat the subject not as a problem by itself, relating only to the sheltering of ships, but to treat it as one feature only of the problem of the Hudson bay route as a whole. To this end it was necessary to consider and obtain all possible information relating to roadsteads, entrance channels, harborage, docks, facilities for providing railway terminals and other works necessary for the transhipment of goods, length of season open to navigation, ice conditions, and possible future inland communication by improvements to existing waterways, and to the feasibility of approach by the proposed railway. It was realized that the importance of the port and the Hudson bay route as a whole depended in no small degree on the efficiency of the rail communication inland.

In accordance with the above, surveys were made of the harbours at the mouths of both the Churchill and Nelson rivers, the results of which have been sent forward to you.

The results at Nelson seem to justify the recommendation that a further appropriation for an accurate survey of that port be made before it is rejected as a terminus for the Hudson Bay Railway.

(Sgd.) JOHN ARMSTRONG,
Chief Engineer, Hudson Bay Ry. Surveys.

THE ESTIMATE.

CLEARING.

The estimate is based on right of way 150 feet wide with the necessary allowances added for sidings and terminals. A few miles of heavy clearing will be encountered, but the average over the whole line will be comparatively light. The first 200 miles will be through spruce and jack pine with a small proportion of poplar and tamarack. The northern 100 miles of the Churchill route will have practically no clearing. The northern 200 miles of the Nelson route will be through spruce with a small proportion of jack pine and tamarack and will probably have from 12 to 15 acres per mile to clear. A large portion of the clearing on both routes could probably be done for $25 or $30 per acre, but owing to the heavier clearing encountered at intervals an average price of $40 per acre has been decided upon. This should be ample to cover whatever close cutting is required as well.

GRUBBING.

This item is somewhat difficult to estimate without an actual location profile. One and a half acres per mile has been used for 400 miles of both lines, using the price $100 per acre which seems to be the price bid by contractors almost universally. The work will class as light, a large proportion of it being such as can be done with heavy grading or breaking ploughs.

GRADING.

This being the chief item in the estimate, considerable care has been taken with it. The quantities submitted are taken from the projected profiles, and the greater portion of these being very close to the preliminary lines, should be as accurate as is possible without cross sections. Engineers in the field were instructed to take out these quantities liberally, and the estimates submitted by them are probably at least 10 per cent in excess of what the profile actually shows.

In addition to this, 25 per cent has been added to all quantities by this office, to cover drainage, settlement, &c., so that the quantities here reported are approximately 35 per cent in excess of what the profile actually shows. This should provide for all possible contingencies, especially as one of the main causes of swelling of estimates, viz.: road and farm crossings is not met with here. In addition, 1,100,000 cubic yards are added to Churchill route and 900,000 cubic yards added to Nelson route for sidings and terminals. At the present time not one single road or farm crossing exists between The Pas and Hudson bay. The prices adopted, $1.80 for solid rock, 65 cents for loose rock and 30 cents for earth, approximate closely to the prices obtained on the Transcontinental Railway in what may be termed similar country, viz.: districts C, D and E. The price 30 cents for earth is perhaps somewhat lower than Transcontinental Railway prices, but I am confident that the contractor who bids over 30 cents on this work will have no chance to get the contract. The portion from The Pas to Hudson Bay Junction of the Canadian Northern Railway, a much worse proposition than any we have encountered, was done at a profit, for 25 cents during the high wage period of 1906 and 1907.

These prices quoted are of course the average. In making up the estimate the prices used on the northern portion were, for solid rock $2, loose rock 75 cents and common excavation and borrow 50 cents. The summation of the quantities and cost

on the different sections resulted in the above quoted averages of prices which have been used in this estimate. On sections 1 and 2 the engineers did not esimate any loose rock. For this reasan the 25 per cent added to their common excavation has been classified as loose rock. The classification made has been based on the Transcontinental Railway specification. The accessibility of the work will not be so difficult as supposed. The first section has rail communication to The Pas with a fairly good steamboat connection already established to Moose lake, 50 miles along the route. The construction of wagon or sleigh roads from this point on will be easy. The second section, with communication from Winnipeg via Lake Winnipeg and the Nelson river, can be made quite adequate for the comparatively small sum of fifteen or twenty thousand dollars. In case the Churchill route is selected this will be more expensive. The third section may be supplied from Churchill or Nelson if so desired. In the case of Nelson good water connection being possible for 60 or 70 miles inland. In case the Churchhill route is selected probably steam shovels will be required on a section of about 35 miles near Split lake. These water routes suggested are not recommended for the transport of such plant as this, but will be useful for all lighter supplies and materials. On the Nelson route no steam shovel work is anticipated, except blasting—the plant for which will follow along behind the track.

TIMBER.

On the Churchill route a sufficient amount of timber for ties, piles, and temporary work may be had convenient to the line on the southern portion as far as the 240th mile, but beyond this point none can be had. For this reason piling has been quoted as 50 cents per foot on the Churchill route, as against 40 cents on the Nelson route, where timber may be had all the way to the bay. The quantities estimated for piling do not look very large, but it is to be remembered that all our stream crossings are very low, thus cutting down the length of the piles and also reducing the length of bridging or number of bents required. With the exception of the Saskatchewan river crossing and the crossing of the Deer river on the Churchill route all waterways have been estimated for, as temporary wooden structures.

On the Nelson route the Saskatchewan crossing and the two crossings of the Nelson are to be steel and concrete, all others wood. Our expedition is practically the first which has obtained definite and specific information of the country through which it is proposed to run, but inasmuch as practically all the work was done in the winter months with everything frozen solid and under three or four feet of snow it is perhaps too much to expect that a proper estimate of water openings could be made. For this reason temporary wooden structures of such a nature as will suffice for a period of from 7 to 10 years has been estimated for.

During this period close observation of the waterways will enable us to specify with more certainty the style and size of opening required. With this closer knowledge of what is required, and with the increased facilities for handling cement and other materials for permanent structures, the final cost will probably be less than if an attempt were made to construct them now.

Cedar timber for culverts may be had f.o.b. cars in Winnipeg for $18 and $20 per thousand, and with freight added is worth $22 to $25 at The Pas. The price of $40 thus leaving from $15 to $18 for framing and contingencies, and is probably high enough to cover the cost of what little excavation may be needed. If timber native to the country can be used, such as spruce and tamarack, a considerable saving may be effected. My own experience has been that such timber is quite good for seven years, and I know of some spruce culverts built twelve years ago and still good.

The timber for trusses and stringers being imported from British Columbia will be more expensive, but will be approximately the same for both lines.

IRON.

An average of 5 cents per pound has been adopted, based on Winnipeg prices, plus freight to The Pas.

TRACK MATERIAL.

Steel rails of 60 pounds per yard are proposed. Much of the material of which the roadbed will be composed is of a peaty nature and some settlement may be expected. Under such circumstances it is probable that a better track can be maintained with the 60 pound rail than with the 80 pound rail. Prices are based on Fort William prices plus freight to The Pas, wheelage charges, &c., and an allowance of about $3 per ton for contingenciese.

TIES.

Estimated at 3,000 per mile for all tracks. Being obtainable at all points on the Nelson route 40 cents each has been adopted, but none being obtainable beyond Split lake on the Churchill route, 50 cents has been used for that estimate.

SWITCHES.

In the estimate for switches is included split switch points, spring frogs, switch stands, lamps, and an allowance of $15 to cover the difference between common ties and switch ties at each switch.

TRACK LAYING.

The prices on the Transcontinental Railway vary from $400 per mile to $600 for laying the 80 pound rail there used, so that $500 per mile should be ample price for laying the lighter 60 pound rail proposed for this line.

BALLASTING.

Indications are that we will not find it necessary to exceed a maximum haul of 25 miles except in the northern 100 miles of the Churchill route, where a 50 mile haul may be encountered. However, as ballast may be found closer, $1,000 has been estimated for both routes and includes side tracks and terminals as well as main tracks.

WATER TANKS.

This question has been fully looked into, and it is found, from the Great Northern Railway experience, that $5,000 should build a tank of 50,000 gallons capacity, of the most approved pattern and as nearly frost-proof as has yet been devised; including machinery and heating apparatus inside the tank. As water is very plentiful in our country the intake and piping will not be expensive.

In addition to the above items discussed there is left for you to estimate upon, station houses and terminal structures, shops, docks and elevators.

In the estimate a side track of 5,000 feet was assumed every eight miles, with a station house, water tank, and accommodation for two section crews at every alternate one. This leaves each section crew the somewhat lengthy section of 8 miles and also situated at one end of the section. It has, however, the advantage of always having the section crew where the superintendent or road-master can always communicate quickly by telegraph or telephone.

Passenger traffic, express traffic and small package freight for a number of years at any rate cannot be very large, so that the accommodation in the station

may be cut to a minimum. Out-going local freight will consist largely of timber which requires no shelter, and incoming local freight will be mostly for lumber camps, the most bulky articles of which, such as hay, oats, flour, pork, &c., if necessary can be better accommodated in a separate warehouse of much cheaper construction. Thus the accommodation of our stations will be principally limited to the requirements of the railway agent. A few years after the opening of the railway the principal centres of development will have become apparent, and more suitable station and freight sheds erected as required.

TERMINALS.

The Churchill route, 477 miles approximately, is too long for three engine divisions in this hard winter climate. The Nelson route, 410 miles, can probably be handled by three train divisions, as owing to the better grades the 135 mile Nelson division will not be a harder task for the engine than the 120 mile in Churchill division. On the Nelson route this will mean four sets of buildings, and on the Churchill route five sets.

CHURCHILL ROUTE.

	Unit.	Quantity.	Rate.	Amount.
			$ cts.	$ cts.
Clearing	Acre	7,000	40 00	280,000 00
Grubbing	Acre	600	100 00	60,000 00
Grading	C. yd.	9,740,000	0 50	4,870,000 00
Piling	L. ft.	180,000	0 50	90,000 00
Timber in culverts	B. M.	3,250,000	40 00	130,000 00
Timber in bridges and trestles	B. M.	4,000,000	55 00	220,000 00
Iron in bridges and culverts	Lb.	2,600,000	0 05	130,000 00
Steel rails	Ton	54,000	40 00	2,160,000 00
		18,000		*720,000 00*
Angle bars	Ton	2,680	50 00	134,000 00
		900		*45,000 00*
Bolts and nuts	Ton	454	80 00	36,320 00
Spikes	Ton	2,040	65 00	132,600 00
Ties	Each	1,700,000	0 50	850,000 00
Track-laying	Mile	567	500 00	283,500 00
Switches (complete)	Set	300	250 00	75,000 00
Water tanks	Each	30	5,000 00	150,000 00
Steel bridges, steel	Lb.	3,700,000	0 05	185,000 00
" concrete	C. yd.	6,000	15 00	90,000 00
Ballasting	Mile	567	1,000 00	567,000 00
Telegraph line	Mile	477	300 00	143,100 00
Total				10,586,520 00
Increase due to 89 lb. rail				*765,000 00*
				11,351,520 00

Station buildings, telegraph stations, section houses, round houses, locomotive and car repair shops, power plant, tools, warehouse at port, coal unloading plant	$1,700,000 00	
Two 4,000,000 bush. cap. fire proof elevators	4,000,000 00	
Yard facility at terminals	320,000 00	
Engineering, law costs and contingencies, 10%	1,737,152 00	
	$7,757,152 00	
Harbour work, piers, dredging, exclusive of lighthouse and buoying	$6,675,000 00	
		$19,108,672 00

NELSON ROUTE.

		Rate.	Quantity.	Amount.
		$ cts.		$
Clearing	Acres.	40 00	7,000	280,000
Grubbing	"	100 00	600	60,000
Grading	Cu. ft.	0 40	7,500,000	3,000,000
Piling	L. ft.	0 40	200,000	80,000
Timber in culverts	M. ft., B. M.	40 00	2,800,000	112,000
Timber in bridges and trestles	" "	55 00	3,200,000	176,000
Iron in bridges and culverts	Lb.	0 05	2,100,000	105,000
Steel rails	Ton.	40 00	45,500	1,820,000
			15,000	*608,000*
Angle bars	"	50 00	2,280	114,000
			800	*40,000*
Bolts and nuts	"	80 00	390	31,200
Spikes	"	65 00	1,740	113,100
Ties	Each.	0 40	1,450,000	580,000
Switches	Set.	250 00	240	60,000
Track-laying	Mile.	500 00	483	241,500
Water tanks	Each.	5,000 00	25	125,000
Telegraph lines	Mile.	300 00	410	123,000
Bridges, steel	Lb.	0 05	9,400,000	650,000
" concrete	Cu. yds.	15 00	12,000	180,000
Ballasting	Mile.	1,000 00	483	483,000
Total				8,333,800
Increase due to 80 lb. rails				*648,000*
				8,981,800

Station buildings, telegraph cabins, section houses, round houses, repair shops, locomotive and car, tools, power plant, warehouse at port, coaling plant	$ 1,647,600	
Two 4,000,000 bush. fire proof elevators	4,000,000	
Yard facility at terminals	320,000	
Law costs and contingencies. Engineering, 10%	1,476,940	
	7,444,540	
Harbour work, piers and dredging, exclusive of lighthouse and buoying	$5,065,000	
		$16,426,340

PORT CHURCHILL.

THE CHART.

Two charts, or maps, are being furnished with this report. One on a scale of 4,000 feet to 1 inch for purposes of comparison with Port Nelson, and a large one on a scale of 1,000 feet to 1 inch, as a working map. On this larger map are shown also 10 feet contours and other notes in more detail than was possible on the smaller scale. The soundings are reduced to low water level.

GENERAL DESCRIPTION.

Port Churchill is at the mouth of the Churchill river where the river passes through a large tidal flat or lagoon mostly dry at low tide except near the outlet to the sea. The lagoon is surrounded by hills consisting of rock at the sea outlet and of sand and gravel further up the river. The only available situation for docks at present is out near Cape Merry, with the railway terminals from two to three miles up stream

and the townsite from three to five miles up stream. Another townsite is available on the west side, but it would be somewhat difficult to get railway and dock sites.

There is no possibility of improving the Churchill river so as to give inland communication by water owing to its shallowness over its many wide and frequent rapids. The neighbourhood of Port Churchill is practically destitute of all forest growth for miles in all directions, the vegetation being restricted to mosses and patches of coarse grasses along the edges of the water areas.

The main fresh water supply is obtained from the numerous small lakes in the neighbourhood, and is of excellent quality. The tidal flats are thickly strewn with boulders, some so large as to be visible above high water.

TIDES AND CURRENTS.

The main current in the harbour is along the indicated channel of the Churchill river, being approximately down the centre of the lagoon, but striking more against the eastern side towards the harbour mouth. With the ebb tide the current attains a velocity of from six to eight miles per hour, creating a somewhat difficult entrance for low-powered ships. The local pilots prefer to bring in their ships with the incoming tides.

It is quite useless for anything but a steam vessel to attempt the entrance at any other time. The current with the in-coming tide is much less, probably not exceeding 4 miles per hour. The highest tide observed was 13½ feet, and the lowest 8 feet, both probably being subject to modification with a longer series of observations. The water is always more or less salt near the entrance. At low tide fresh water may be obtained in the Churchill channel opposite the Hudson Bay Company's post, but when the tide is in this cannot be done.

ICE CONDITIONS.

The harbour usually freezes over about November 15. The open sea also freezes over during the winter four or five miles out from Churchill. The usual date for the opening of the harbour is about June 19. This last spring the harbour opened on June 7, or about 10 days earlier than usual. The ice lay off the coast and harbour this year, preventing the return of the survey party until July 13, when a start was made for York.

Five days more were lost by the ice pack off Cape Churchill extending about thirty miles out to sea, the boat crew declining to venture outside of this. The boat in use was only a small sailing coast boat not well adapted to ice work. Probably no serious difficulty would have been experienced by a steamer making Churchill within a few days of the opening up of the harbour on June 7. At intervals between June 7 and July 13, ice would be drifted back into the harbour by north winds. This ice floating up and down the harbour on the strong currents existing there constitutes a serious inconvenience and danger to ships at anchor and to docks and other works which may be constructed along the shore. The harbour has been reported on occasions to have been blocked by ice as late as August owing to long continued north winds. This liability of the harbour to being filled with loose heavy ice drifting up and down with the strong currents will need to be seriously considered in choosing the type of docks to be built here. As shown on the chart, the direction of the current tends to throw the drifting ice against the east shore, the only available place for docks at the present time. The ice, however, does not jam here very much but is swept on out by the strong current. Jams more frequently occur on the west side between the police barracks and Cockrill's Point.

ANCHORAGE.

At the present time very little shelter can be had at low tide by any ship drawing over 18 or 20 feet of water. Space to accommodate two or three ships of this size might be had, but anything larger would have to anchor almost in front of the entrance, which being about three-quarters of a mile allows the full force of the seas to be felt. The seas enter the harbour with sufficient force to cause a heavy swell to be felt throughout the harbour; in fact it is reported that at times it is impossible for the smaller boats to cross the harbour for two or three days at a time. The bottom, consisting of mud, affords a fairly good holding ground for anchors.

MATERIAL.

The material forming the harbour bottom is mud, thickly strewn wtih boulders of all sizes, and is probably a deposit from the Churchill river.

Excavating for ships berths close inshore to avoid the heavy drift ice will probably encounter solid rock as the solid rock in several places runs to the water edge.

MATERIALS FOR CONSTRUCTION.

Stone for construction purposes is very plentiful. Marble if you like to use it. All timber will have to be brought in either by rail or by ship.

DEFENCE.

Fort Churchill being practically upon the open sea can only be defended by strong forts and batteries placed in the immediate neighbourhood of the port itself.

PORT NELSON.

THE CHART.

The chart or map accompanying this report has been drawn to a scale of 4,000 feet to 1 inch, as being best adapted for the purpose of giving a comprehensive view of the general situation at Port Nelson. Lines are shown on the chart inclosing the portion which was found open all last season; other lines showing the portion where the ice did not attain a greater thickness than 10 inches. The shore line is plotted in from a traverse of the shores. Wherever the ice was of sufficient strength the sounding was done through holes, the method of locating being indicated on the chart. The soundings in the open water portion were taken from a boat hired from the Hudson Bay Company at York Factory, and were taken in May and June after the ice had gone out. This portion of the work was accomplished under great difficulties, as only five small buoys could be obtained to mark ten miles of river.

The boat, which was the best obtainable, was the usual coast boat of very shallow draft and clumsy rig, but endowed with special qualities in the matter of drifting.

Owing to this propensity and to the fact that the small buoys were not visible from one to the other, some difficulty was experienced in keeping the proper course. However, after ten days or two weeks hard work a sufficient amount of information was obtained to enable us to state with certainty that a good channel exists in which a ship drawing 26 feet might safely enter at all stages of the tide. Mr. R. D. Fry, the engineer in charge of the party, believes this chart to be a conservative representation of the actual conditions at Port Nelson, and that more extended surveys with the proper equipment will probably show a more favourable situation.

In order to get the best results it will be necessary to have a good strong boat equipped with power, preferably a good sea-going tug which could be fitted to burn either coal or wood, with a dozen large sized buoys and fifty or sixty smaller ones to mark the channel and points to be sounded.

GENERAL DESCRIPTION.

Port Nelson is at the mouth of the Nelson river, while York Factory is situated at the mouth of the Hayes river, about fifteen or eighteen miles from Port Nelson.

The site at the mouth of the Hayes was chosen by the Hudson Bay Company on account of the better communication with a greater number of inland posts, and also being a much smaller stream was not so difficult to navigate.

A great deal of tracking had to be done on both rivers, and the Hayes being much smaller, offered less trouble in crossing and re-crossing to take advantage of paths to tow from. The Nelson river is known locally as the North river, and Port Nelson is named by the British Admiralty as York Roads. Hudson bay vessels crossing to York Factory with supplies anchor about 15 or 20 miles from the post in York Roads. The site of York Factory was not chosen on account of its accessibility from the sea, but entirely on account of the easier communication with inland posts. The Nelson river proper may be said to end at Flamboro Head, which is the approximate limit to which the tide reaches. The estuary is a wide tidal flat with the main channel running approximately down the centre, finally discharging into an open sea abreast of Beacon Point, some 25 miles from Flamboro Head. At Flamboro Head the banks rise shear from the water edge to a height of 100 to 125 feet. From this point they gradually diminish in height on both sides of the river, until at Sam's creek on the north, and Beacon Point on the south, they are about ten feet above the water. The north shore is of clay with a sufficient fall for drainage, and covered with a fair growth of spruce.

A good site for terminals and town may be had in the vicinity of the point marked on the chart. Above this point the banks become higher and much more abrupt.

The south shore is also of clay with a good slope for drainage, but at the present time is covered with a very heavy growth of moss, rendering it very wet. An abundant supply of fresh water may be had either from the Nelson river itself or from various smaller streams and lakes in its vicinity.

TIDES AND CURRENTS.

The main current when the tide is ebbing is along the main channel, the current over the flats running approximately parallel to it. As the water lowers the currents over the flats converge more and more upon the main current till at low tide they are approximately at right angles to, and approaching it. On the ebb tide, the current flows at the rate of about 3½ miles per hour, being strongest at the mouth abreast of Beacon Point. Under favourable conditions the current here might rise as high as 4 miles per hour. So great is the discharge of the Nelson river that a perceptible current may be noticed several miles out to sea. With the incoming tide a current of about 2½ miles is obtained.

During the observations, extending from March 20 to June 10, the lowest tide observed was 6·9 feet and the highest 10·9. A longer series of observations will probably establish greater extremes.

The Admiralty charts give ordinary spring tides as ranging from 10 to 14 feet. It is probable, however, that any rise greater than 12 feet may be classed as an occurrence out of the ordinary, and due probably to some particular combination of wind and tide. The tides were found to be very variable, due no doubt, to the comparative shallowness of the water. This will require a long series of observations before ac-

curate tide tables can be prepared. This condition is not peculiar to Port Nelson, but applies generally to the tides in Hudson bay.

Salt water is never found above Beacon Point except when a very strong easterly gale is blowing with the incoming tide, when a slightly brackish taste may be detected two or three miles above Beacon Point. When the tide is ebbing fresh water is obtained far out to sea. Salt water is never obtained within many miles of the point selected for the terminals.

ICE CONDITIONS.

About the 20th December the river is usually frozen over at Seal Island or Flamboro Head. From this time on the ice gradually creeps down the estuary and out from the shore line until the first half of the month of April. About this date the weather moderated to such an extent that the thawing through the day counterbalanced the freezing at night and the ice began to recede towards Flamboro Head, the estuary being usually again clear of ice by May 15. The ice is broken up into large floes by the rising tide, and is borne off out to sea by the ebb tide. Owing to the appreciable current of the Nelson river being felt so far out to sea very little of this ice ever drifts back again. Between May 15 and June 1, the upper Nelson ice breaks up and passes down the centre of the estuary in the main channel, usually occupying from 24 to 36 hours in passing out to sea. During last winter no ice jams occurred inside of a line drawn from Beacon point to Sam's creek and a careful scrutiny of the shore line after the snow and ice had disappeared failed to find any trace of its ever doing so. The photos accompanying this report give a fair representation of the usual ice conditions at Nelson. Last winter was a shade colder than average.

The winter of 1878, an exceptionally mild winter, the channel remained open for 40 miles above Flamboro Head.

During the freeze up in the fall, a considerable quantity of slush ice comes down from the upper Nelson.

Last winter at Seal island and along the shore the ice attained a thickness of between 4½ and 5 ft. The average thickness at York Factory, where a record has been kept for many years, seems to be about 4 ft. 8 inches.

During the Winter more or less ice floats up and down the open channel with the tides, but being very scattered no jams ever occur.

ANCHORAGE.

The anchorage being some nine or ten miles in from the mouth of the channel no serious sea is ever experienced which may cause trouble to anything larger than canoes or row boats. The condition of the seas at Port Nelson will probably be found to resemble those experienced at Quebec on the St. Lawrence. The bottom is of sufficient stiffness to furnish a secure holding ground for anchors.

MATERIAL.

The material in the flats consists of blue clay with an occasional pocket of coarse sand and gravel with boulders scattered thinly around. In the channel the material is a very stiff blue clay, affording excellent holding ground for anchors. Probably all of the material can be handled by dredges at a very low cost and may be used for reclamation works around the docks. The bottom of the channel is swept clean and bare by the current of the Nelson, and is of so stiff a nature that the small anchor used by the Survey, probably weighing about 200 lbs. would frequently drag for some distance before taking hold. The material on the flats is not so hard on top, but becomes harder as depth is obtained.

MATERIAL FOR CONSTRUCTION.

Stone for the construction of breakwaters and other works may be cheaply obtained. About 75,000 or 100,000 cubic yards may be picked up along the tidal flats in the shape of scattered boulders. Up the Nelson river, about 40 miles above Flamboro Head is a splendid quarry where any required quantity can be had, and landed cheaply at the works by means of the Nelson river.

Piles in large quantities will be obtainable from various streams entering Nelson river and Hudson bay.

Cement and other materials, being brought in by water, should be comparatively cheap.

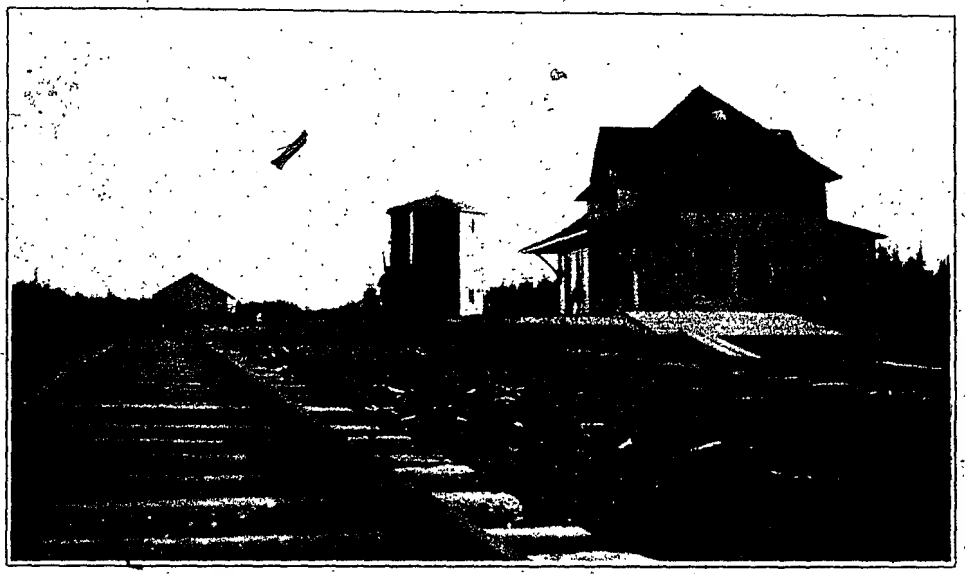
DEFENCE.

The defence of Nelson from hostile fleets will be comparatively easy, the long comparatively narrow channel approach being easily rendered impregnable by means of sea mines, and rendered otherwise dangerous by the removal or changing of buoys and other channel marks. Battleships which carry the extreme long range guns are of such a draft as to render it somewhat dangerous to manœuvre in less than 45 ft. of water, thus preventing their closer approach than 15 or 18 miles, a distance considerably greater then the effective range of even the heaviest guns. The lighter ships which might approach closer carry correspondingly lighter guns. The establishment of strong batteries and forts at Sam's creek would seem to be all that is necessary to render Port Nelson absolutely unassailable.

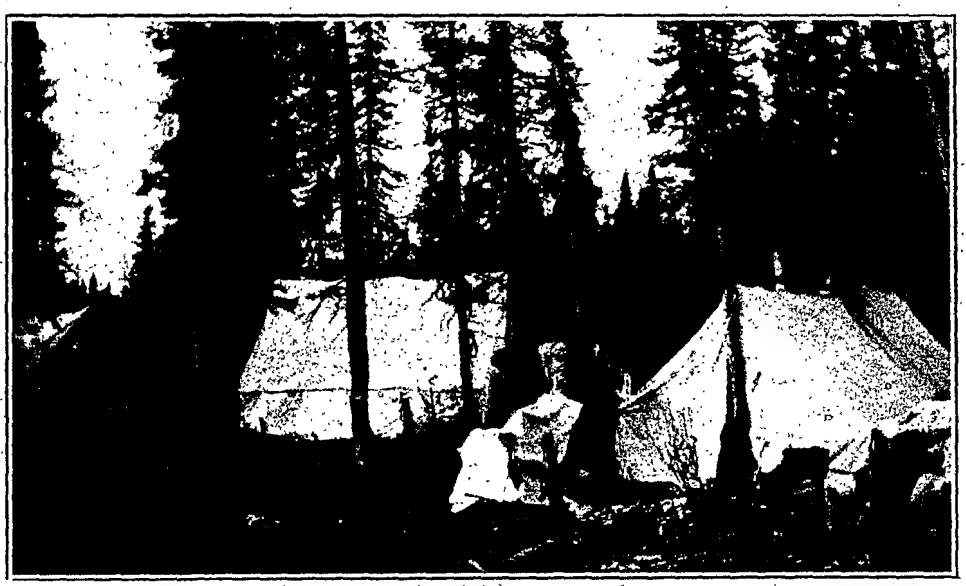
It might be mentioned here in passing, the greatly increased difficulty a hostile fleet would have on blockading the Atlantic coast of Canada were the Hudson bay route opened. The fact that ships may enter and leave Port Nelson all the year round is a fact worth remembering when the possibilities of war are considered.

(Sgd.) JOHN ARMSTRONG,
Chief Engineer Hudson Bay Railway Surveys.

WINNIPEG, Sept. 8, 1909.



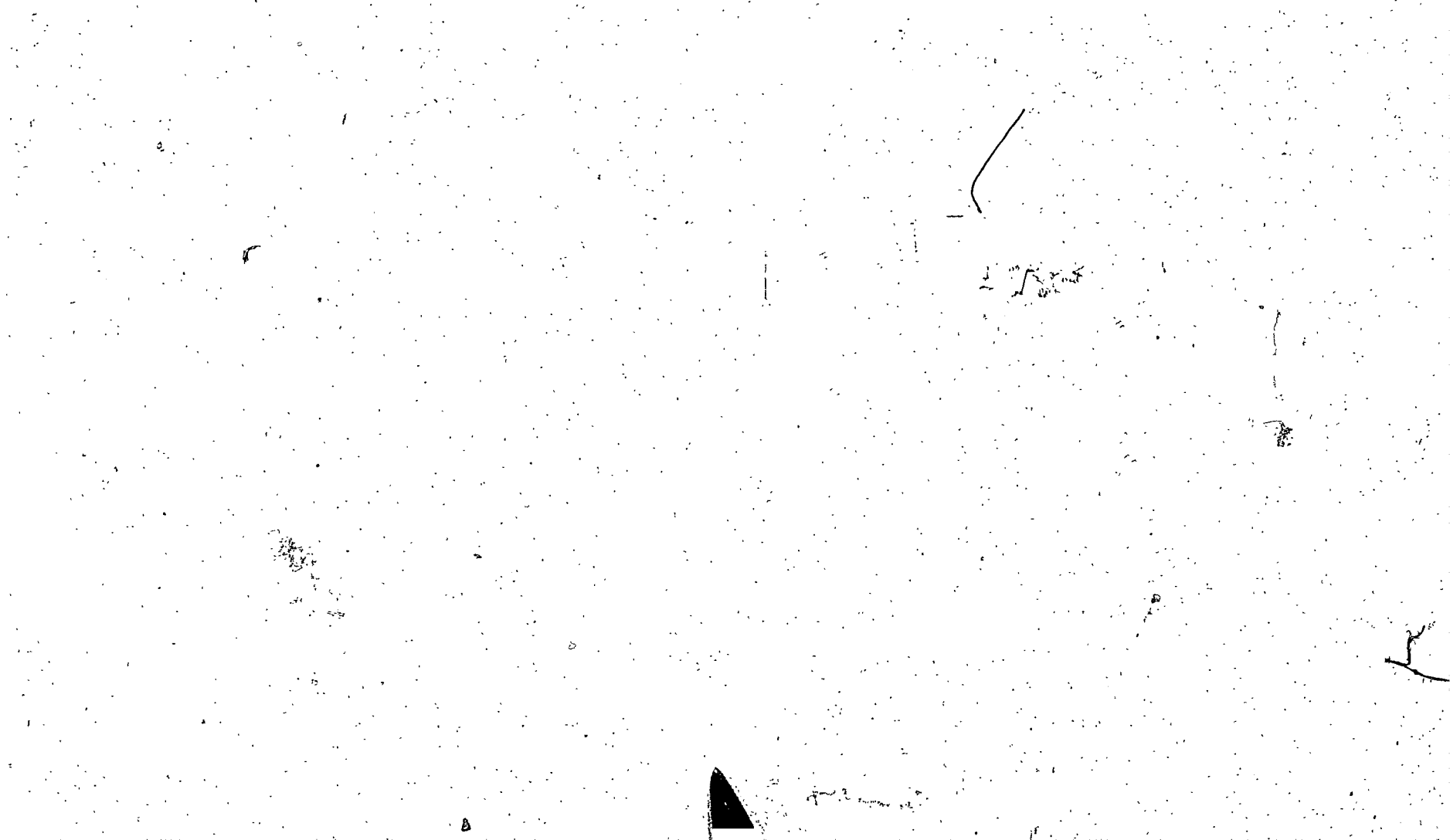
The Pas Station, C. N. Railway.

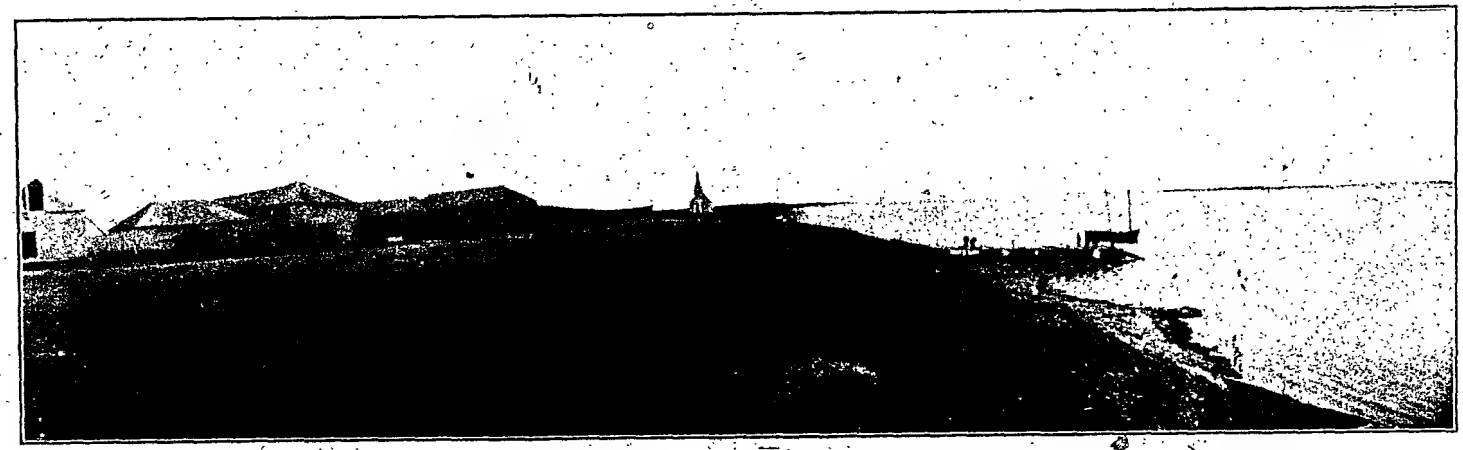


The Pas to Split Lake.

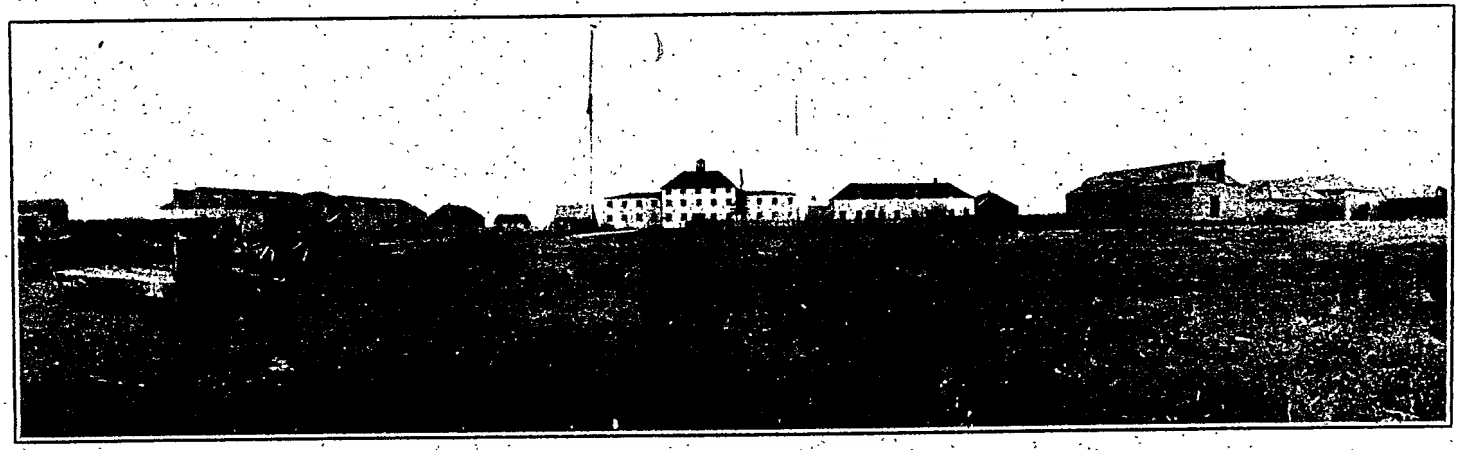
Metishto Creek, Winter.

R. N. M. P., Churchill.

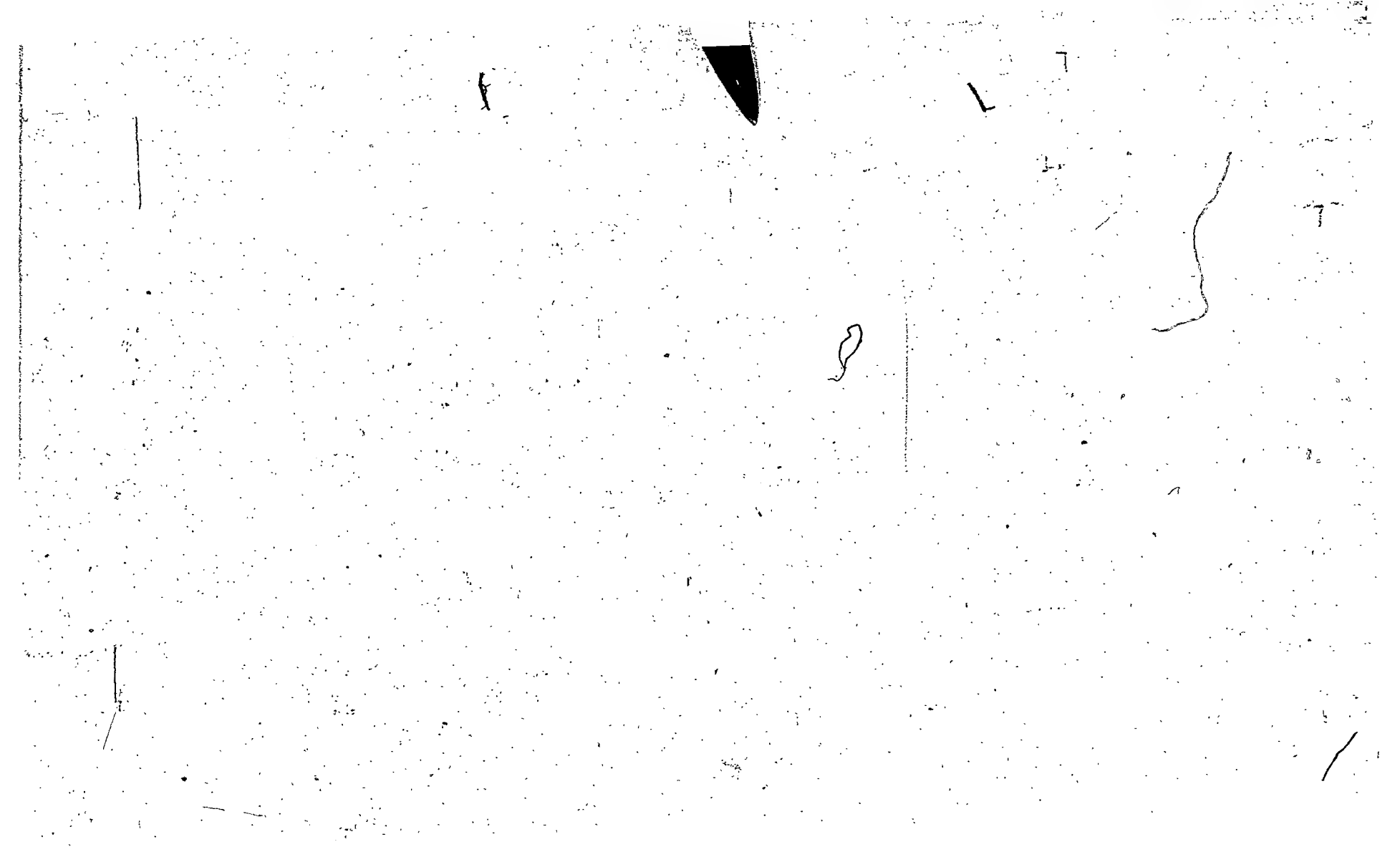


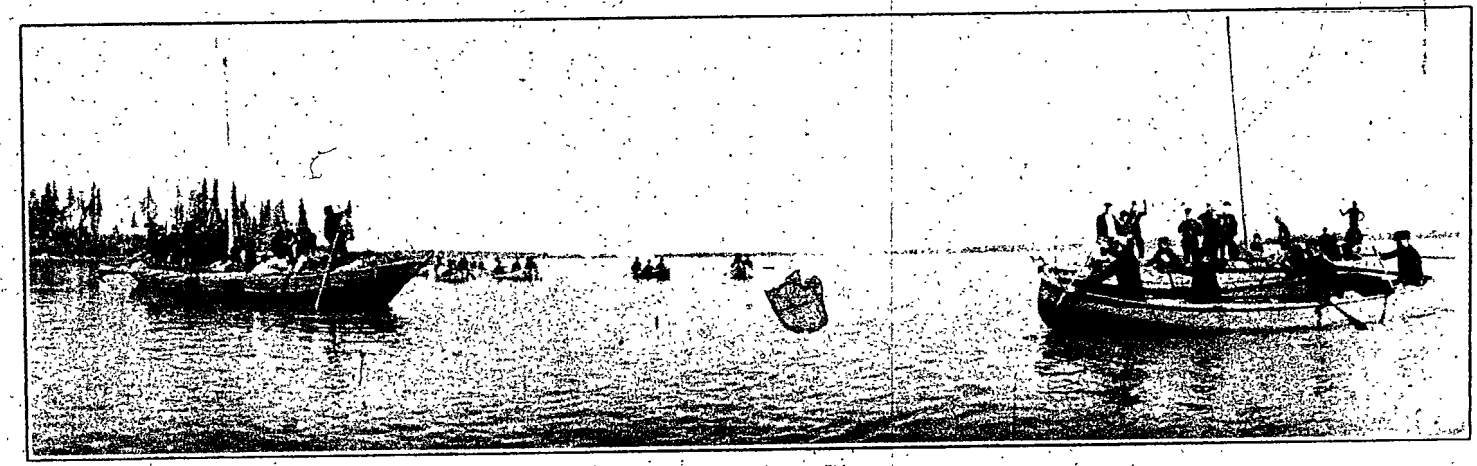


Mouth of Hayes River, York Factory.

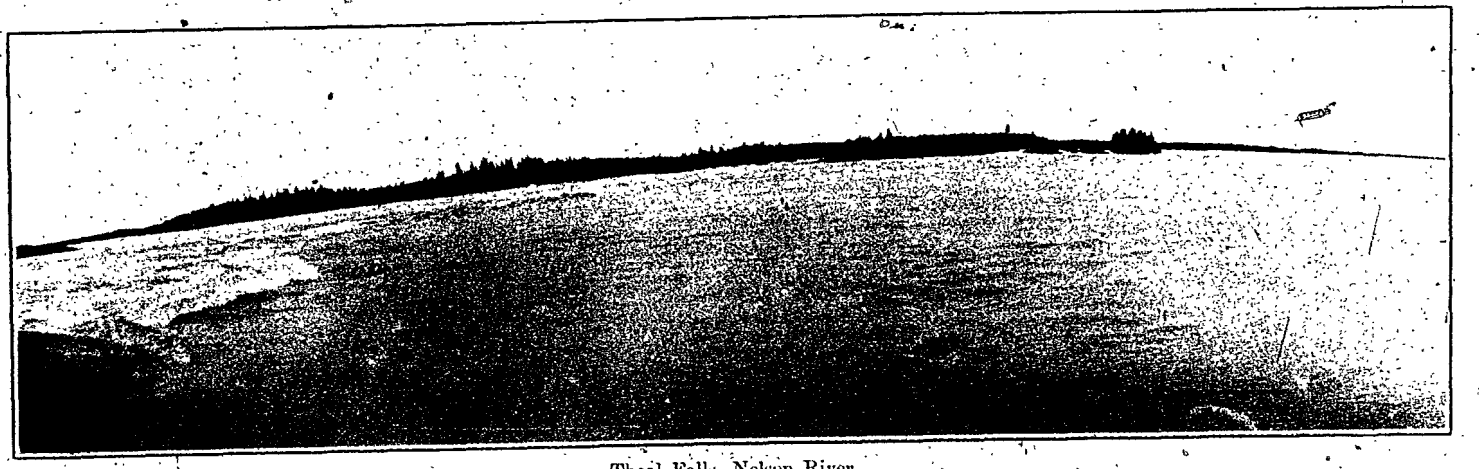


York Factory.

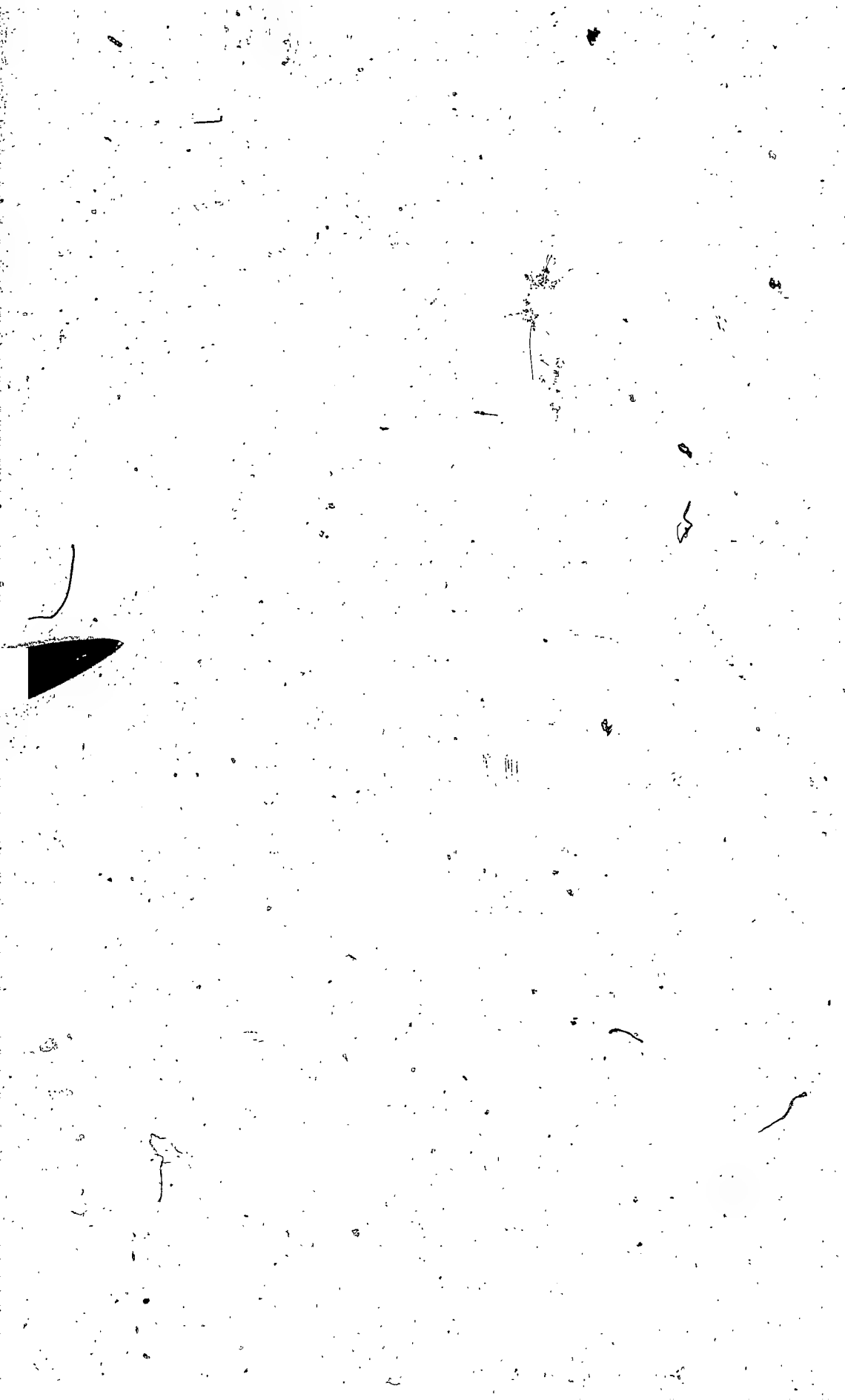


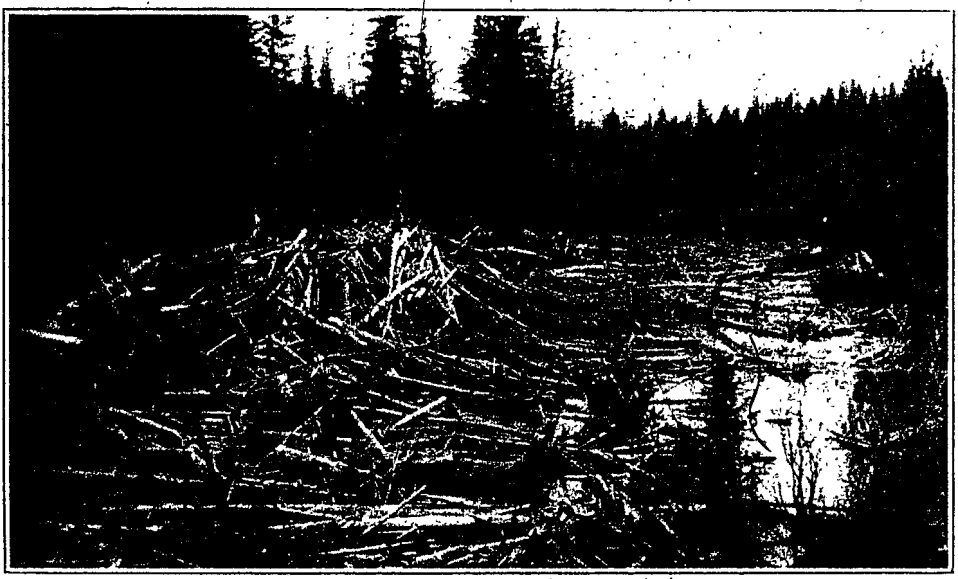


Expansion of Nelson River.

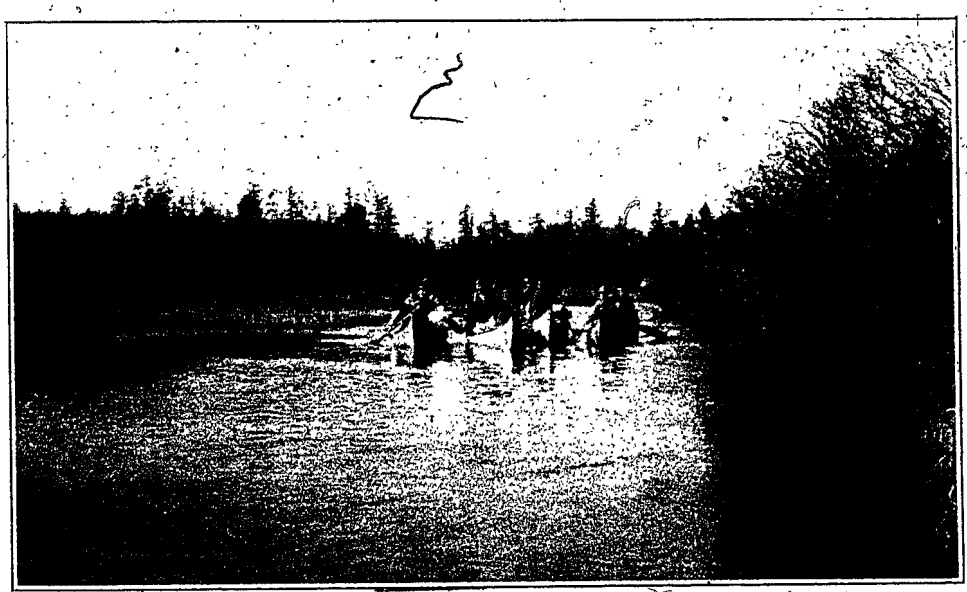


Thoal Falls, Nelson River.

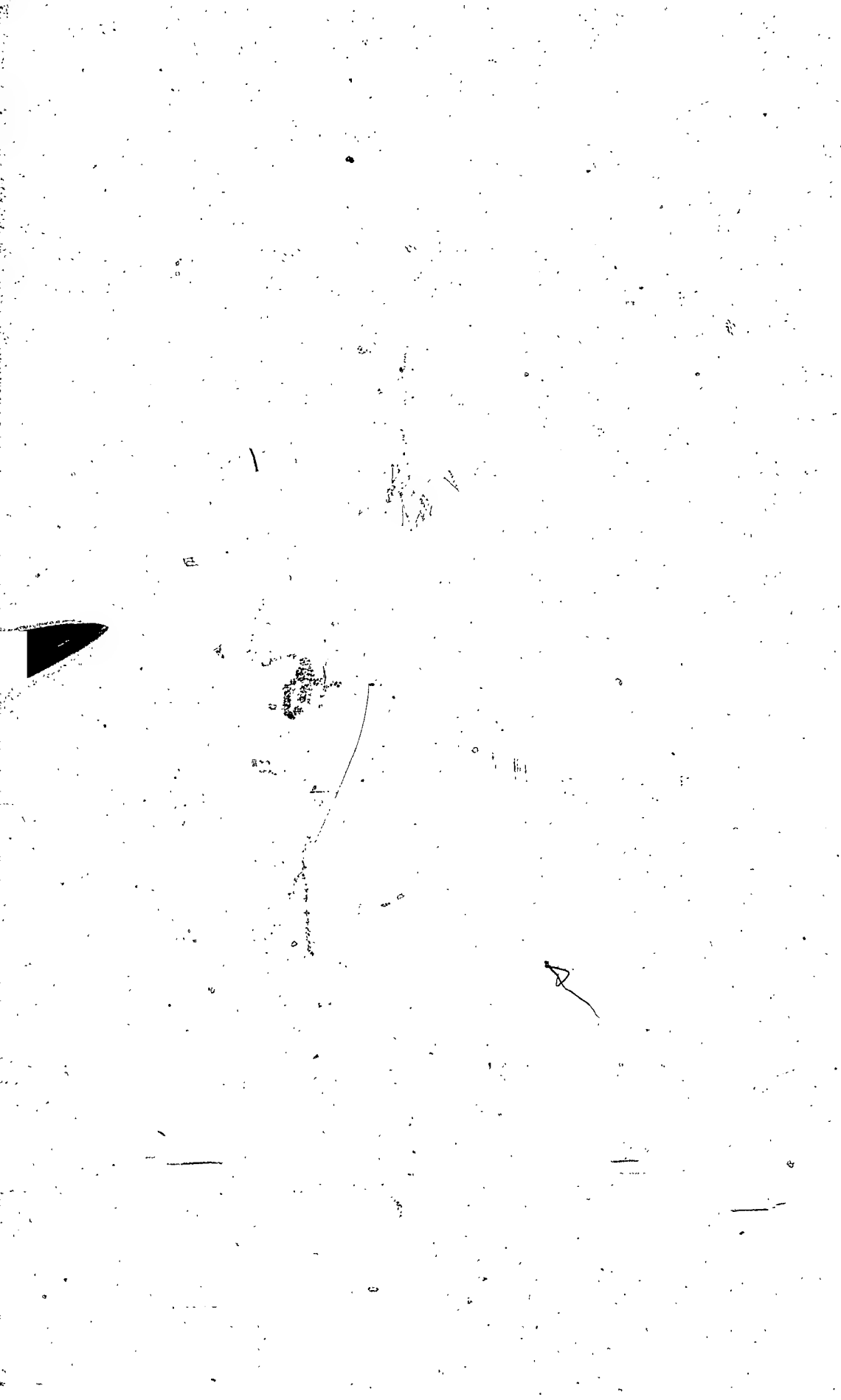


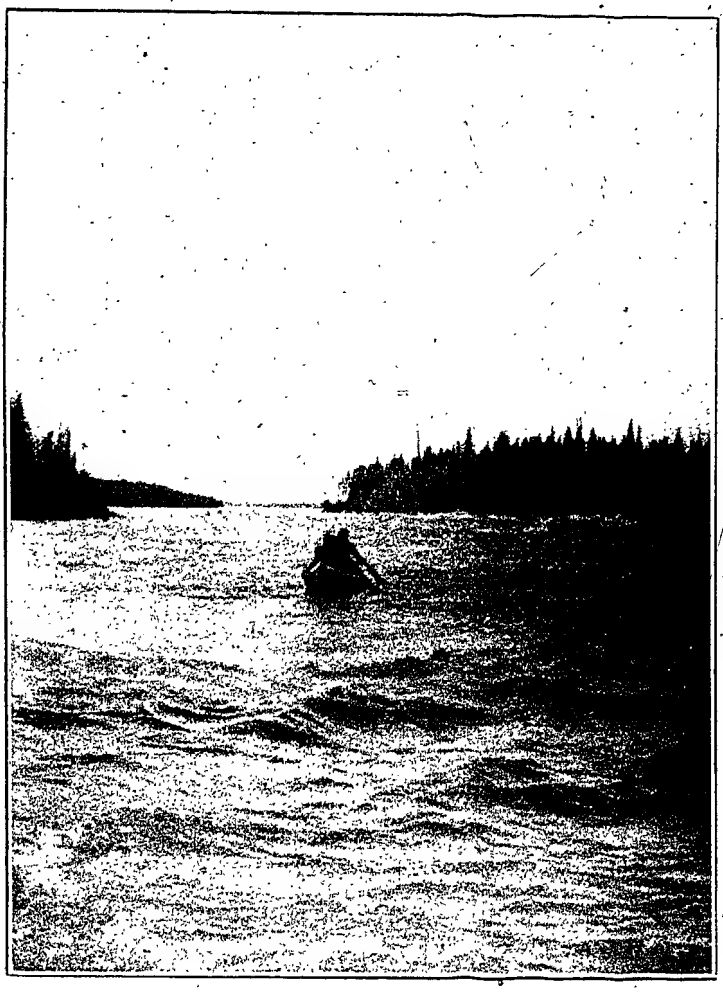


Log Jam, Metishto Creek.

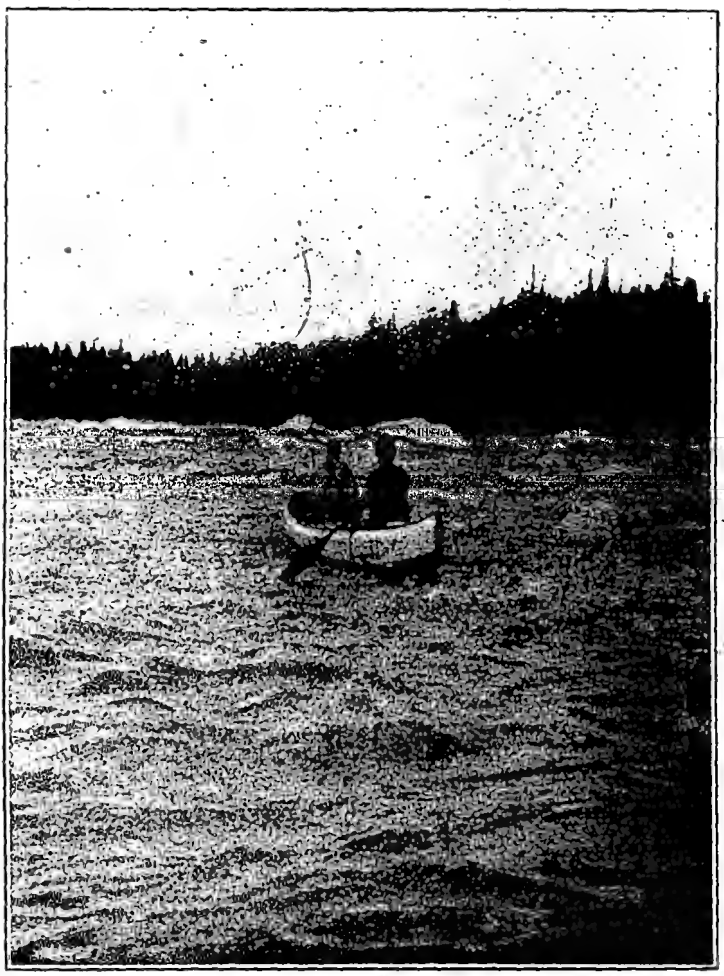


Metishto or Limestone Creek.

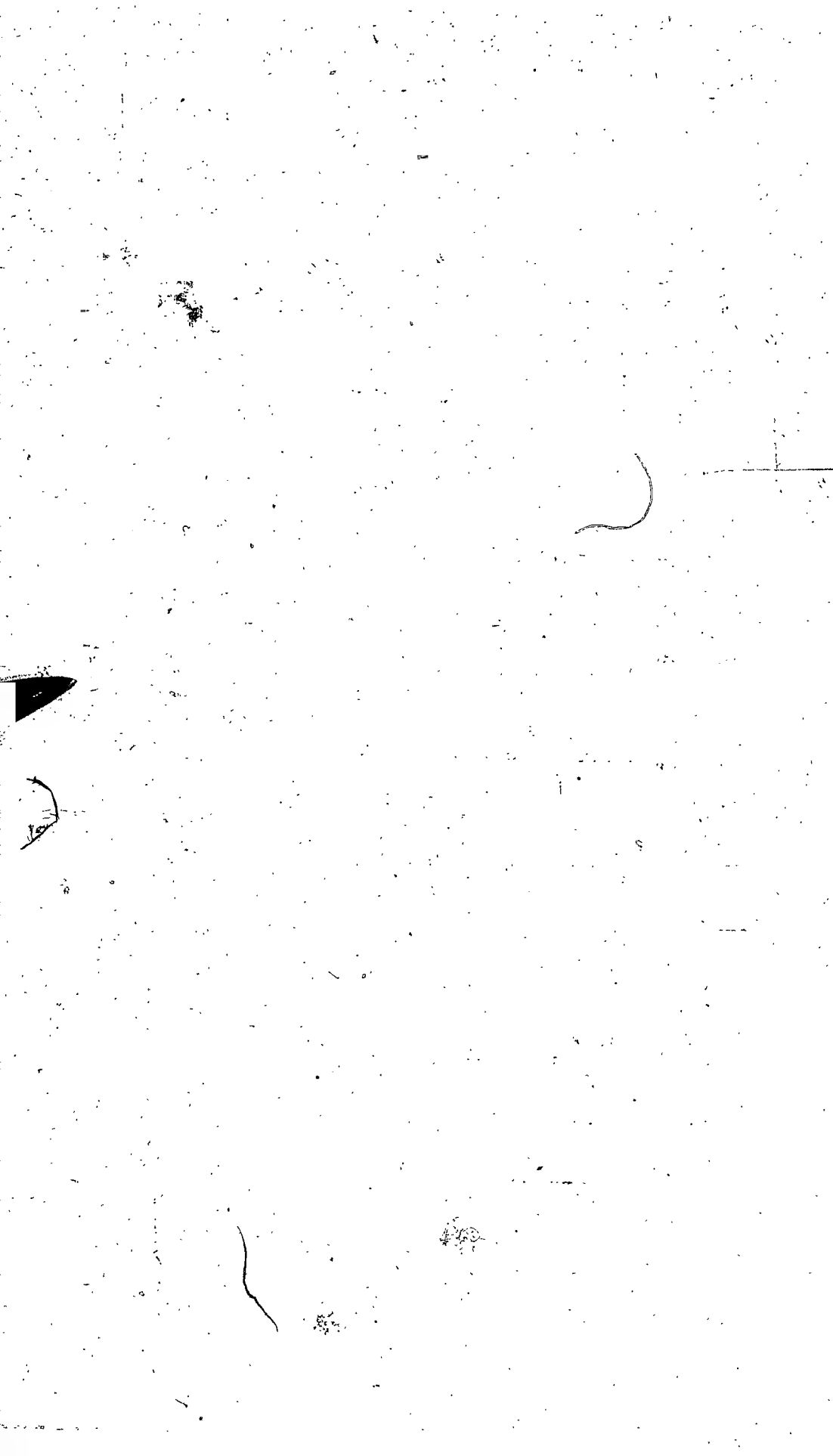




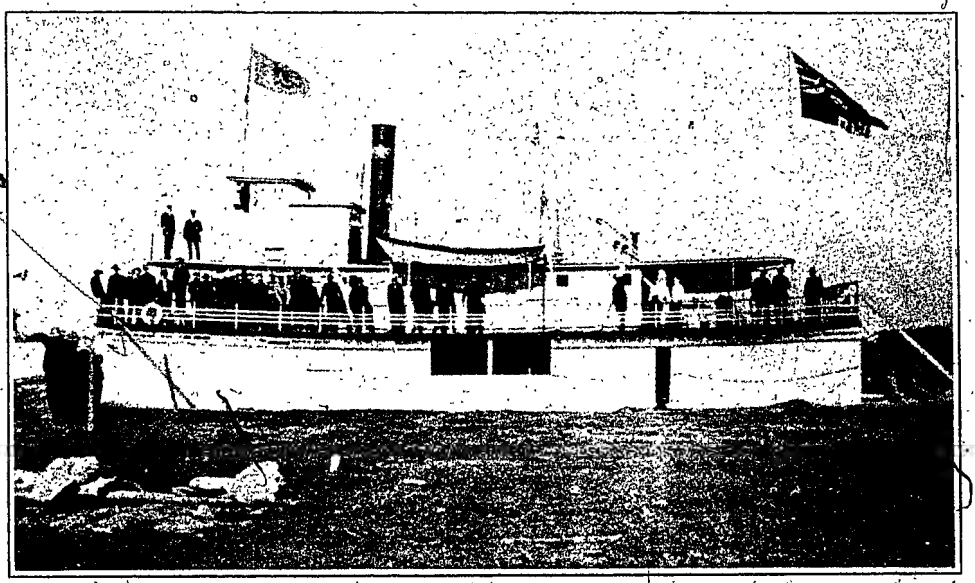
Manitou Rapids, Nelson River.



Little Manitou Rapids on Nelson River.



At the Manitou Rapids, Nelson River.



Hudson Bay Company's Steamer "Saskatchewan."

Metishto Lake.

DEPARTMENT OF RAILWAYS AND CANALS

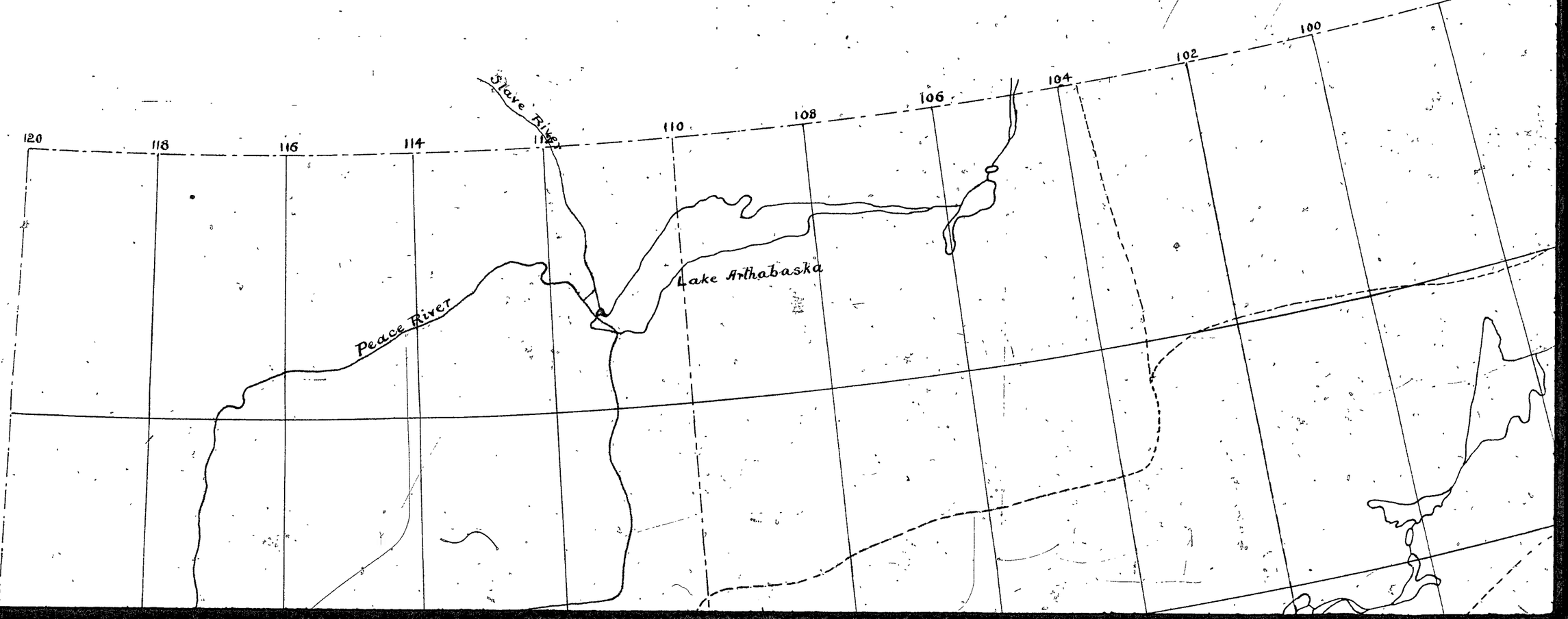
MAPS

TO ACCOMPANY

REPORT ON

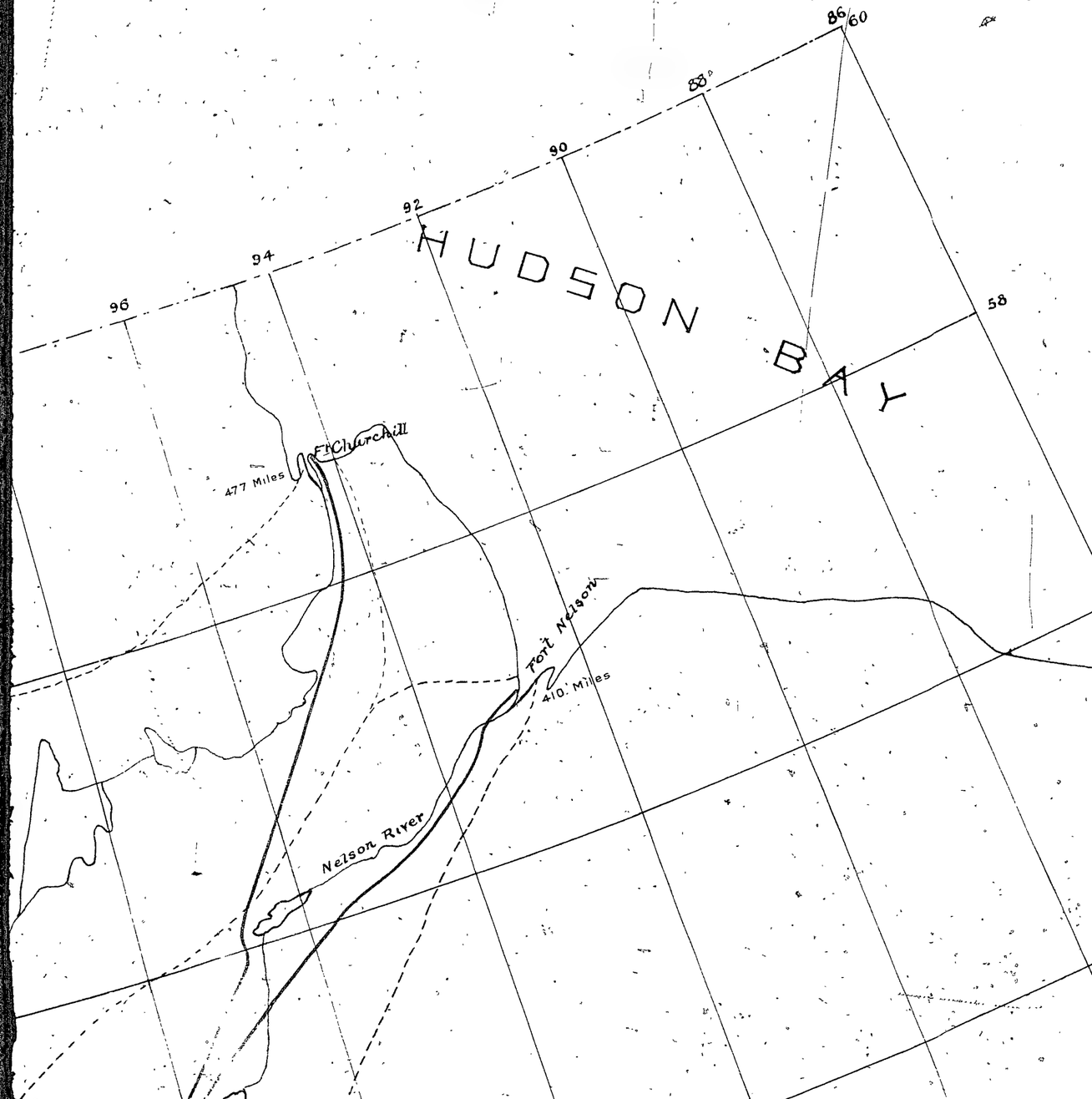
HUDSON'S BAY RAILWAY SURVEYS

16


120
118
116
114
112
110
108
106
104
102
100
98
Slave River
Lake Athabaska
Peace River

28

GENERAL MAP
OF
NORTH-WESTERN CANADA
SHOWING
RAILWAYS AND NAVIGABLE WATERS



Sgd John Armstrong
Chief Engineer
Hudson Bay Ry Surveys

Scale - 50 miles to an inch

NOTE

- NELSON RIVER BASIN
- CHURCHILL RIVER BASIN
- MACKENZIE RIVER BASIN
- NAVIGABLE WATERS
- C.P.R. LINES
- C.N.R. LINES
- G.T.P. LINES
- G.N.R. LINES
- PROPOSED LINES

308

Churchill River.

Athabaska River

NORTH SASKATCHEWAN RIVER

EDMONTON

WETASKIWIN

WAINWRIGHT

BATTLEFORD

LACOMBE

PRINCE ALBERT

SASKATOON

THE PAS

Carrot River

Saskatchewan R

PASQUIA HILLS

Lake Winnipegosis

YORKTON

MELVILLE

CALGARY

South Saskatchewan R

REGINA

MOOSE JAW

MEDICINE HAT

WEYBURN

demarkation between the territory tributary to Winnipeg and that tributary to The

C.P.R. LINES

G.T.P. LINES

G.N.R. LINES

PROPOSED LINES

52

50

48

46

Split Lake

Lake Winnipegosis

Lake Manitoba

Lake Winnipeg

MANITOBA

DAUPHIN

Ochre tributary to The Pas

WINNIPEG

PORTAGE LA PRAIRIE

BRANDON

SOURIS

EMERSON

Red River

MINNESOTA

PORT ARTHUR

LAKE SUPERIOR

Duluth

406

WETASKIWIN

WAINWRIGHT

BATTLEFORD

LACOMBE

SASKATOON

YORKTON

MELVILLE

REGINA

CALGARY

South Saskatchewan R

MOOSE JAW

MEDICINE HAT

WEYBURN

MACLEOD

Line of demarkation between the territory tributary to Winnipeg and that tributa

MONTANA

NORT

5 of

MANITOBA

Lake Manitoba

YORKTON

DAUPHIN

VILLE

Tributary to Winnipeg and thus tributary to The Pas

PORTAGE LA PRAIRIE

WINNIPEG

BRANDON

SOURIS

EMERSON

BURN

Red River

MINNESOTA

PORT ARTHUR

LAKE SUPERIOR

Duluth

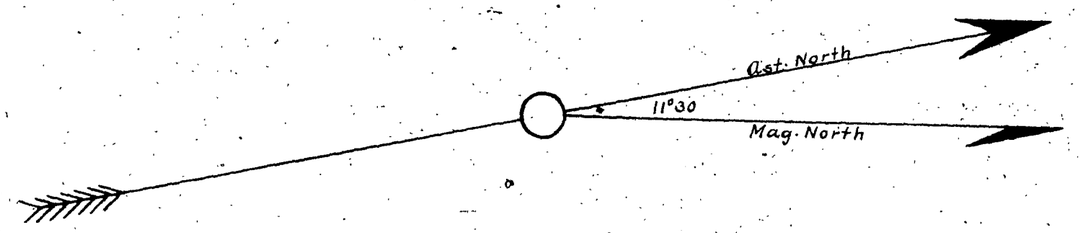
48

46

NORTH DAKOTA

6086

1 of



PORT CHURCHILL.

Scale. 4000 ft. to an inch.

NOTE

Soundings are in feet and reduced to Low Water Level.

30 ft. line shown thus. .....
15 ft. line shown thus - - - - -
Pier space for 9 boats, any additional to be cared for by mooring buoys fore and aft, as there is no possible room for free anchorage.

John Armstrong
Chief Engineer
Hudson Bay Ry. Surveys.

BUTTON BAY

CHURCH

FLATS

LOW TIDE

H.B.C

N.W.M.P Barrack

Appr. High Water Line.

Appr. Low Water Line.

Rock 60'h

Battery Beac

26

Ast. North

11°30

Mag. North

RCHILL.

BUTTON BAY

w Water Level

fore and aft,

John Armstrong
Chief Engineer
Hudson Bay Ry. Surveys.

H.B.C

appr. High Water Line.

N.W.M.P. Barrack

Rock 60h

F.P. of Wales

Eskimo Point

Beacon

appr. Low Water Line.

FLATS

DRY AT LOW TIDE

Cape Merry

Battery Beacon

Hospital Point

RIV

BAY

ON

NOTE

Soundings are in feet and reduced to Low Water Level.

30 ft. line shown thus .....
15 ft. line shown thus - - - -
Pier space for 9 boats, any additional to be cared for by mooring buoys fore and aft, as there is no possible room for free anchorage.

John Armstrong
Chief Engineer.
Hudson Bay Ry. Surveys.

CHURCHILL RIVER

H.B.C

N.W.M.P Barrack

appr. High Water Line.

Rock 60h

FLATS

LOW TIDE

appr. Low Water Line.

Mosquito Point

MUD

PARTLY DRY AT

Limit for Tide

appr. Low Water Line.

Site for Mechanical Shops and Yard

Battery Beacon

appr. High Water Line

N8°11E.

Beaches Cabin.

Lake

308

o Low Water Level.

buoys fore and aft.

John Armstrong
Chief Engineer
Hudson Bay Ry. Surveys.

H.B.C.

appr. High Water Line.

N.W.M.P. Barrack

Rock 60ft

F. of Wales Beacon

Eskimo Point

Cape Merry

Battery Beacon

appr. Low Water Line.

Mosquito Point

RIVER

MUD FLAT

PARTLY DRY AT LOW TIDE

Limit for Steamers

Site for Mechanical Shops and Yard

appr. Low Water Line.

appr. High Water Line

N 8° 11 E.

HUDSON

Beaches Cabin.

Lake

4064

10

PORT NELSON.

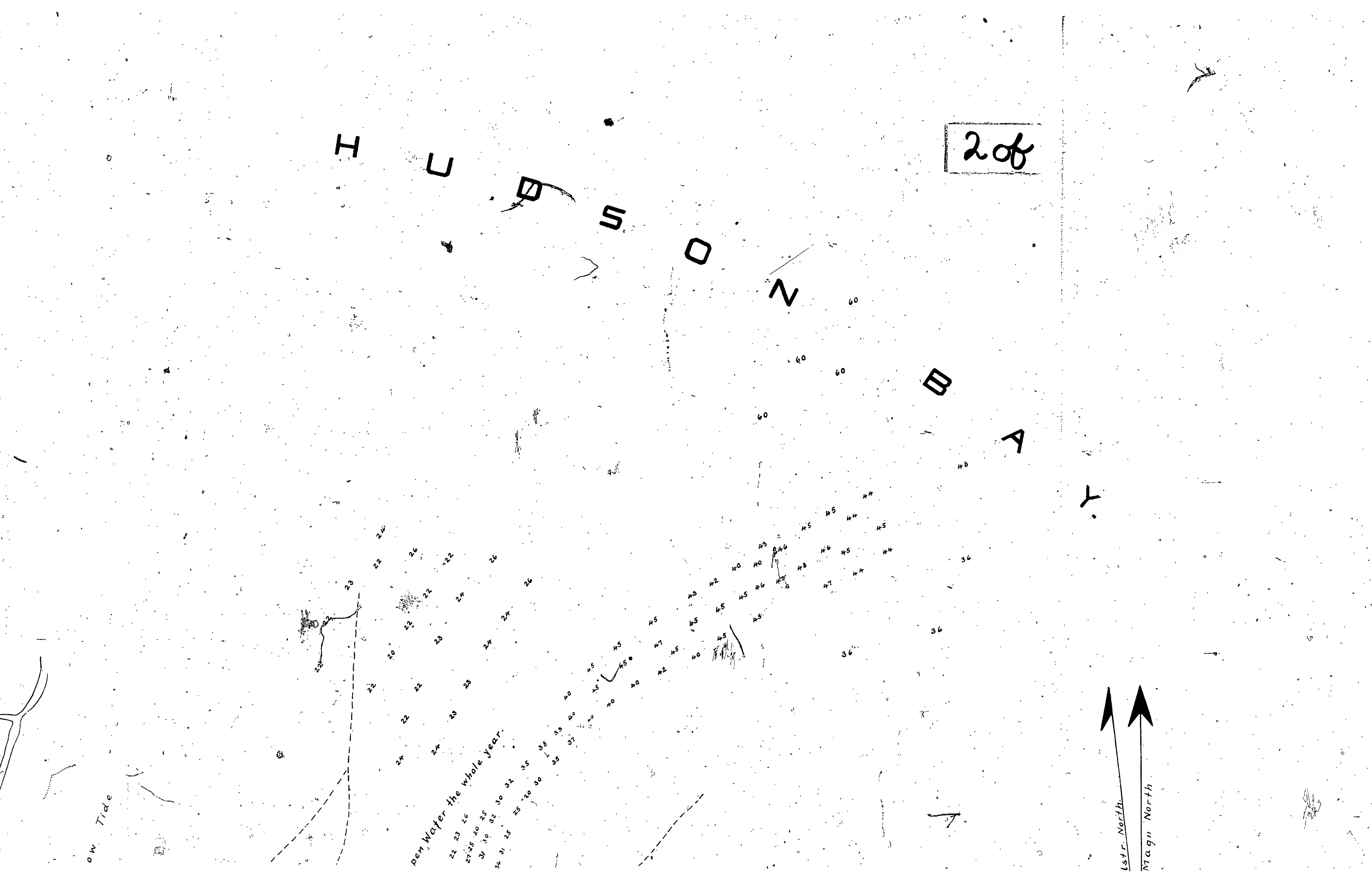
Scale: 1 inch = 4000 feet.

NOTE.

Soundings are in feet and reduced to Low Water Level.
Contours are figured from Low Water Level.

Sam's Creek

2 of


HUDSON BAY
pen Water the whole year.
ow Tide
Astr. North
Magn North

John Armstrong
Chief Engineer.
Hudson Bay Ry. Surveys.

308

Tidal Flats

Clay.

Spruce 5" Diam.

site for

al flats partly dry at Low Tide

than 10' thick

Ice inside this Area less

This Area has open Water the whole yea

Astr. North.

6°45'

Magn. North

406

ats partly dry at Low Tide

Beacon Pt

58

Spruce 5" Diam.

site for
Mechanical Shops and Yard

Ind. House

Clay.

Spruce. 8" Diam.

Clay.

RIVER

Tidal flats

Beacon Pt.

10

20

30

York Factory

Hayes Is.

HAYES RIVER

68

708

Spruce. 8" Diam.

Flamborough Hd.

Spruce. 10" Diam.

Clay.

Seal Island

Extreme Limit for Tide

NELSON RIVER

Clay.

Spruce. 7" Diam

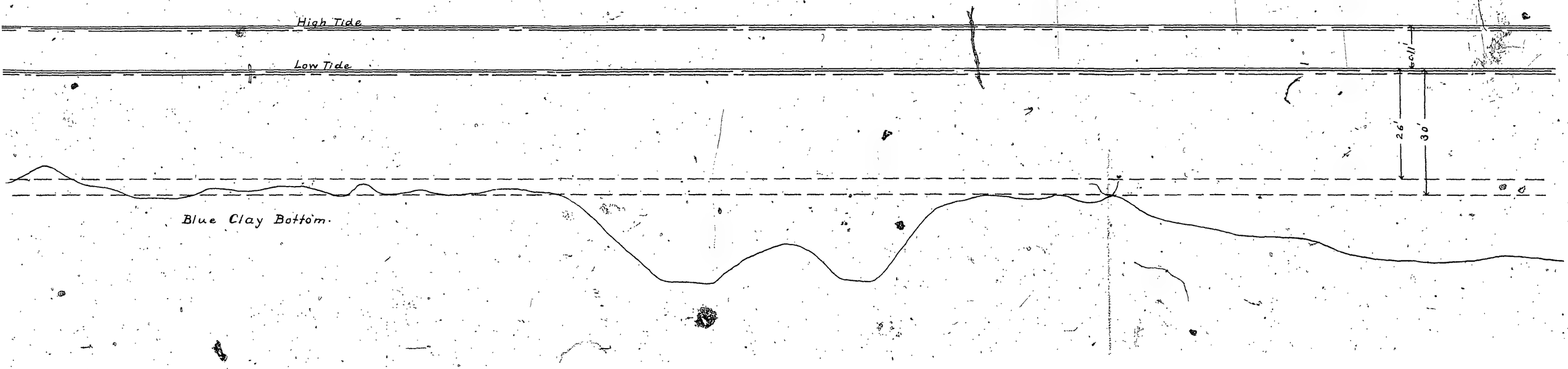
Spruce.

Clay.

PROFILE OF SHIP CHANNEL.

1888

Scale. Hor. 1" = 4000'
Ver. 1" = 20'



10

THE
HUDSON BAY RAILWAY

PLAN
SHOWINC
PROPOSED LOCATIONS

H U D

AILWAY.

TIONS

95

94

59

96

Port Churchill.

Button Bay

E. Eskimo

C. Merry

477

450

Open

Scatter

Trees alon

308

H U D S O N

B A Y

95

94

93

59

59

96

Port Churchill

Button Bay

C. Eskimo

C. Merry

477

450

C. Churchill

Open Tundra Country
Scattered Bunches of small
Trees along Creeks and Lakes

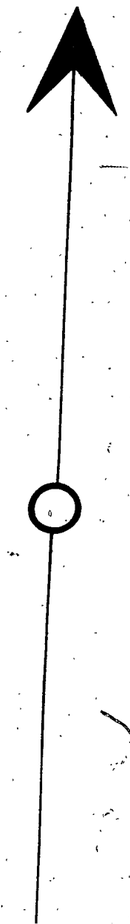
PROPOSED LOCATIONS
FROM
THE PAS MISSION TO HUDSON B

Scale 10 miles to an inch.

10 5 0 10 20 30 40 50 miles.

John Armstrong
Chief Engineer.
Hudson Bay Ry. Surveys.

406



BAY.

58

97

57

Chukchill River

Dog Rive

Deer R

Approximate Southern Boundary Barren Lands

400

Elv. 589.0

Owl River

Churchill Lake

Little Churchill River

Harvey Lake

350

Small Timber

Pike Lake

Elbow Lake Elv. 561.0

Hilly and Rolling country mostly Clay with ridges of Sand and Gravel

Churchill Route

North Fishing Lakes

Considerable Areas of Good Timber

Clay Soil

Nelson River

Big Lake
Elv. 670.0

300

Clearwater Lake

Chukchill River

Do

Deer

58

Broad River

58

Approximate Southern Boundary Barren Lands

400

Owl River

Elv. 589.0

608

Lake

Little Churchill River

Harvey's Lake

350

Small Timber

Rollus Lake

Hilly and Rolling country mostly clay with ridges of Sand and Gravel

Elbow Lake Elv. 561.0

Little Churchill River

Churchill Route

Big Lake
Elv. 600.0

300

Clearwater Lake
Elv. 603.0

North Fishing Lakes

Considerable Areas of Good Timber

Clay Soil

Nelson River

400

410

Port Nelson

Beacon Pt.

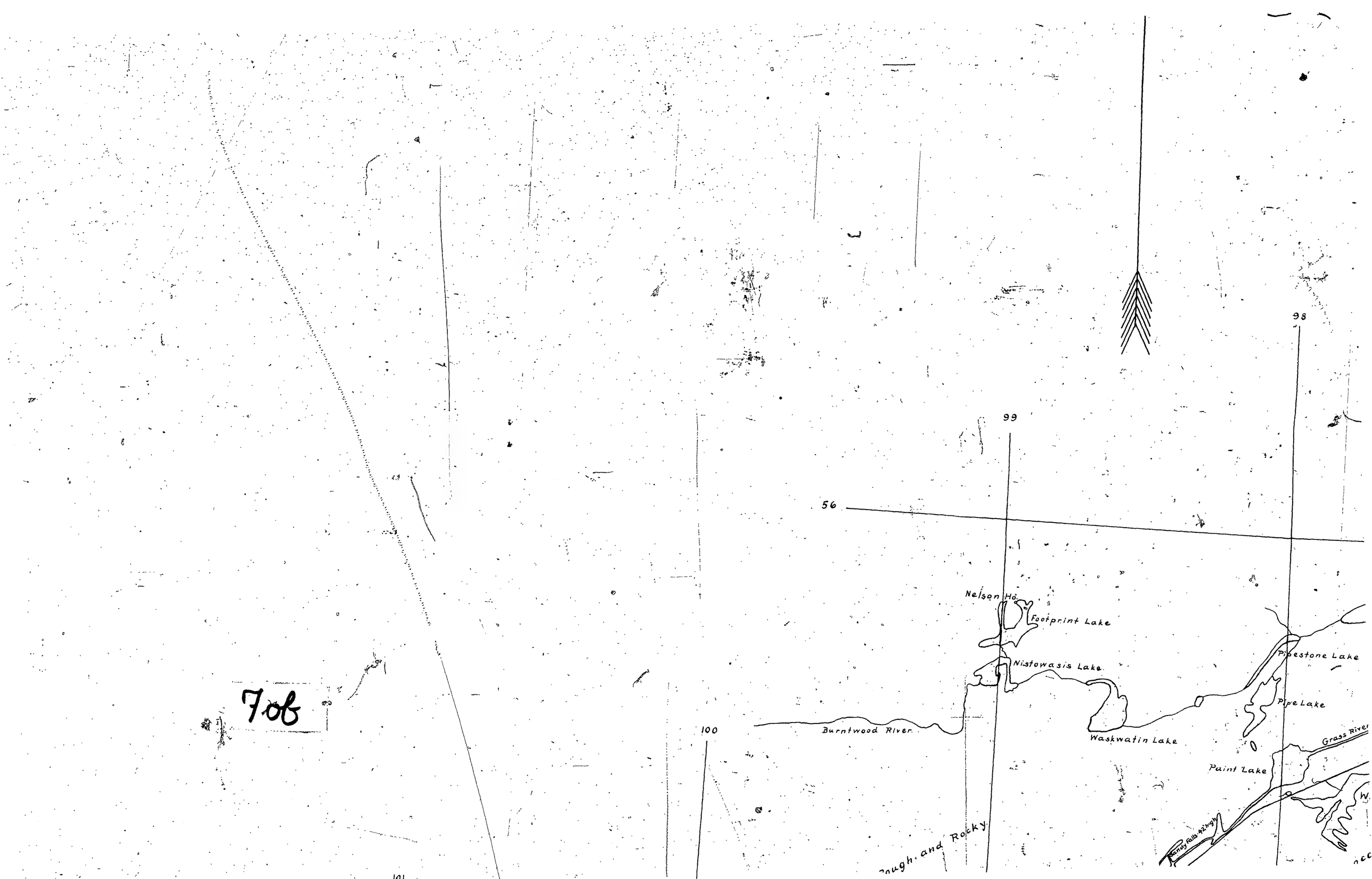
57

York Factory

Flamborough Hd.

Oseal Is

Limit of Tide


98
99
56
Nelson Ho.
Footprint Lake
Nistowasis Lake
Pipestone Lake
Pipe Lake
Burntwood River
Waskwatin Lake
Grass River
Paint Lake
Sandy Falls 42' high
100
101

708

806

57

98

Hilly and Rolling Country mostly Clay with ridg of Sand and Gravel

Churchill Route.

Elbow Lake Elv. 561.0

Little Churchill River

Big Lake Elv. 610.0

300

Clearwater Lake Elv. 603.0

O.Ma-Tou-wi Lake

North Fishing Lakes.

Considerable Areas of Clay Soil

Limestone River

Assean Lake Elv. 520.0

Lit Assean L.

H.B.Co

250

Split Lake Elv. 495.0

Gull Lake

Kettle River

Nelson Route.

Very broken Rocky Country

Odei River

Fall 25 high

Grass River

Burntwood River

Stinking L. Elv. 549.0

Grand Rap.

Kettle L.

Lit Fox L.

Fox Lake and Lakes

Fox River

Smooth Clay Country sloping gently and uniformly to Hudson Bay

Teal Lake

Natawahoonan

Pipestone Lake

Pipe Lake

Partridge Crop Lake

Good Timber

Manitou Rap

Nelson River

Grass River

Wintering Stream

Paint Lake

Wintering Lake Elv. 561.0

200

Occasional Rock out-crop

Good Timber along Leaf River

Deer Lake

Clearw

Hilly and Rolling Country mostly of Sand and

Elbow Lake Elv. 561.0

Little Churchill River

Churchill Route

Big Lake
Elv. 670.0

300

Clearwater Lake
Elv. 603.0

O Ma Tou-wi Lake

North Fishing Lakes

Considerable Areas of Good Tim

Clay Soil

Nelson River

Limestone River

350

Stamborough Hd

Osea I Is

Limit of Tide

906

Cranberry River

Hayes River

Lit Assean L.

H.B.Co

Gull Lake

Angling Lake

Kettle River

300

Nelson Route.

56

rand Rap

Kettle L.

250

tou Rap

Smooth Clay Country sloping gently and uniformly to Hudson Bay

Lit Fox L

Fox Lake

Fox River

Streams and Lakes

Good Timber along Leaf River

Hayes River

Berwick Fall

Whitemud Fall

Deer Lake

Mossy Por

Seeing Por

93

er River

100

101

55

54

Rough and Rocky

Good Timber.

Lyns Falls 43 high

Sandy Falls 42 high

Rapids Rapid 11/2 fall

150

150

150

Level Clay Country with

Goose River

Getting River

Getting Lake
Elv. 693.0

File Lake

Reed Lake

Grass River

Pakwabigan Lake

Wekusko Lake

Sunday Lake

100

Low Granite Ridges

Metishto River

Good Timber

Some Good Clay Soil

Muhigun River

Duck Lake

Cowan River

Metishto Lake
Elv. 835.0

Good Limestone

Height of Land

Blue Lake

50

Pickerel R.

Frog River

Cormorant Lake
Elv. 813.0

Good Timber

Moose Lake
Elv. 812.0

Minago River

Lake Hill

Kiskitto Lake

Kiskittogisu Lake

Clearwater Lake
Elv. 828.0

Limestone Ridge

Low and Swampy

West River

Lit Playgreen L.

East River

Reeds Lake

Saskeram Lake

The Pas

0

Carrot River

William Lake

Rossville

Norway Ho

Playgreen

Landing Lake

Clearwater River

Clearwater Lake

Rear Lake

Trout Lake

Back Lake

Swampy Lake

Seeing Por

Mossy Por

Pors

Knee Lake

Wolf R

Oxford Lake

Oxford Ho
H.B. Co.

Walker Lake

Windy Lake

Rat Lake

Lake Max

Pipestone Lake

Echimamich River

Molson Lake

1106

55

94

95

54

Reeds Lake

Saskeram Lake

The Pas

Carrot River

To Etoimami C.N.Ry.

Low and

Moose Lake

H.B.Co.

Saskatchewan River

H.B.Co.

Cedar Lake

William Lake

Limestone Pt

West R.

Lit Playgreen L.

Playgreen Lake

Mossy Pt.

Lake Winnipeg.

Cross Lake

Grand Rapids

H.B.Co.

53

101

100

99

98

1206

West R

Lit. Playgreen L

East River

Rossville

Norway Ho

1

54

Playgreen Lake

ine Pt

Mossy Pt

McLaughlin River

Gunisao River

Belanger River

Lake Winnipeg.

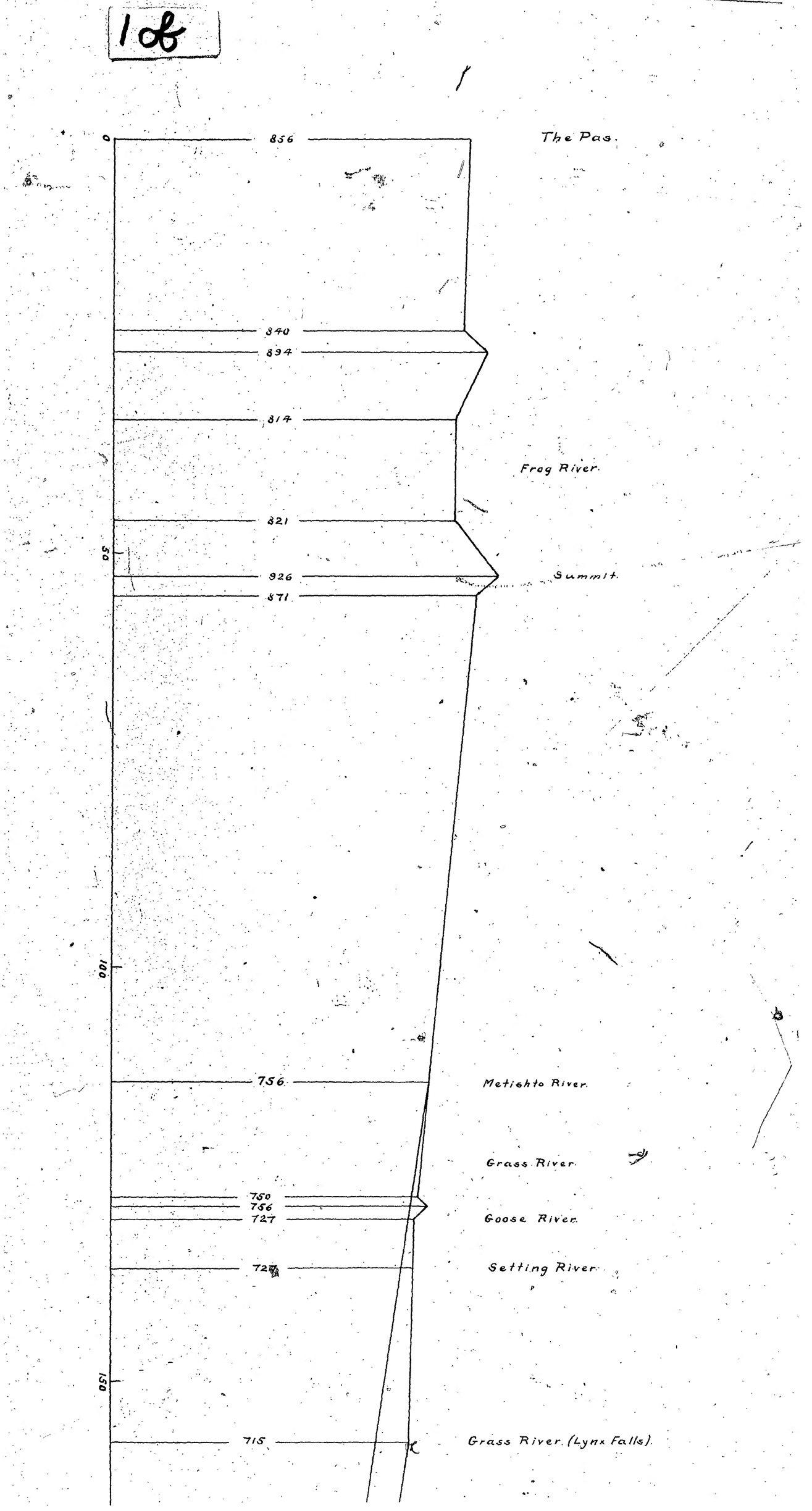
96

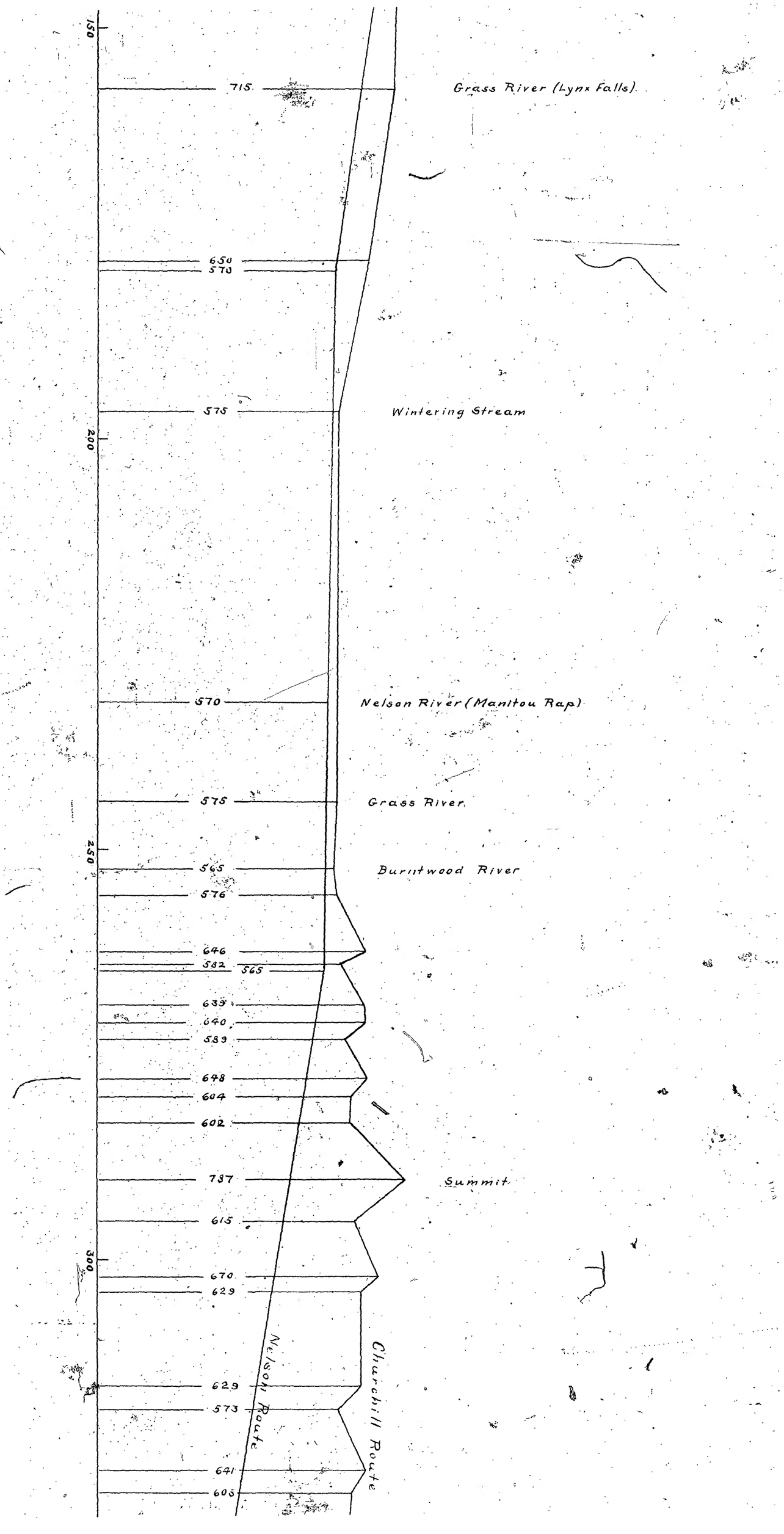
53

98

97

13 of 13


1 d
0
50
100
150
856
The Pas.
840
894
814
Frog River.
821
926
Summit.
871
756
Metiehto River.
Grass River.
750
756
727
Goose River.
720
Setting River.
715
Grass River. (Lynx Falls).


150
200
250
300
715
650
570
575
570
575
565
576
646
582
565
639
640
589
648
604
602
737
615
670
629
629
573
641
603
Grass River (Lynx Falls)
Wintering Stream
Nelson River (Manitou Rap)
Grass River
Burntwood River
Summit
Nelson Route
Churchill Route

3 of 3

THE HUDSON BAY RAILWAY.

PROFILE OF PROPOSED LOCATIONS FROM THE PAS MISSION TO HUDSON BAY.

John Armstrong
Chief Engineer.
Hudson Bay Ry. Surveys.

SCALE Ver. 200' to an inch.
Hor. 10 miles to an inch.